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ABSTRACT

The purpose of this investigation was to examine the efficacy of various strategies for improving the reading comprehension of readers with deficits in decoding and vocabulary skills. Ninety-six subjects (48 deficit readers and 48 average readers) of approximately the same age and intelligence were selected from a lower socioeconomic middle school. Average and deficit poor readers were compared for performance on a comprehension task under three instructional-treatment conditions and two input modalities. The treatments included imagery, incentive, and control under both reading and listening modalities. Contrary to expectations, instructions to image did not facilitate comprehension for the average readers (under reading or listening) or for the deficit readers (under listening conditions). The deficit readers did improve significantly in comprehension when they moved from a reading to a listening modality. (MKM)

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SOME FACTORS INVOLVED IN THE COMPREHENSION OF PROSE MATERIALS

by John Henry Heckler

Report from the Project on Conditions of
School Learning and Instructional Strategies

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ABSTRACT

The purpose of the present investigation was to examine the efficacy of various strategies in terms of improving the reading comprehension of readers with deficits in decoding and vocabulary skills. To do this average and deficit poor readers were compared for performance on a comprehension task under three instructional-treatment conditions and two input modalities. The treatments included imagery, incentive, and control under both reading and listening modalities.

A total of 96 subjects (48 deficit and 48 average readers) of approximately the same age and intelligence were selected from a lower socio-economic middle school. Poor readers were classified according to the Wiener and Cromer (1967) model and selected on the basis of scores obtained on three standardized tests. The design was one of "repeated measures" such that each subject received two passages (presented in counterbalanced order), one in a printed form and one in a taped version. Prior to receiving the passages, subjects in the three treatment groups received visual imagery instructions, incentive instructions, or were simply instructed to read or listen to the stories.

The findings indicated that performance expectations for the deficit and average readers were generally consistent with experimental predictions for each treatment group except that of imagery. Contrary to expectations, instructions to image did not facilitate comprehension for the average readers (under reading or listening) or for the deficit readers (under listening). Overall, the average readers performed equally well no matter which experimental condition they were in, but the deficit readers improved significantly when they moved from a reading to a listening modality. This improvement across modalities was significant for the deficit readers only, suggesting an interaction of reader type with mode of presentation. Additional information in terms of the amount of imagery reportedly used by each subject and preference for stories suggested some explanations for these findings. In particular, the relevance of pre-training exercises for developing adequate imagery production was discussed.

It was concluded that deficit poor readers can comprehend prose materials as well as average readers when they are presented in a manner which minimizes skills in decoding and vocabulary. It seems that the primary difficulty experienced by these readers is focused on skill deficits in reading and thus other problems in motivation, memory, or association of facts are not necessarily implied. Remedial

implications of these findings were discussed with regard to the matching of teaching strategies with various reader aptitudes.

CHAPTER I

PART I

NATURE OF COMPREHENSION

Because of the large body of literature accumulated in the areas of reading and listening comprehension, the following review will be limited primarily to those studies which are relevant to the author's research purposes. The presentation of the literature is divided into two major parts. Part I provides a brief introduction and discussion of the nature of comprehension and the complexity of factors involved in its definition and measurement. Part II focuses more directly on current research efforts which have investigated remedial strategies useful for improving the comprehension skills of school age children. In general, the review is restricted to those studies which have direct implications for the comprehension of prose materials and the author has purposefully omitted large areas of research which, although critical to understanding the complexity of comprehension, are not directly relevant to the problem investigated in this study.

Defining Language Comprehension

Although listening and reading comprehension are two forms of language behavior that appear very frequently in

educational literature, there continues to be much controversy over exactly what these behaviors mean. The concept of comprehension is a theoretical construct which has been defined in a variety of ways depending on the skills and behaviors which are assumed to underlie this process. At the present time there appears to be no general consensus regarding what skills are actually involved in comprenension or how best to teach it. Reading specialists have only contributed to this dilemma by describing comprehension in terms which are as abstract as the concept itself. Perhaps the most common definition is one which emphasizes that comprehension implies understanding of the meaning of printed or spoken language as contrasted with the ability to perceive and pronounce words without reference to their meaning. Beyond this general view, however, are an assortment of definitions which are founded on differing theoretical assumptions regarding the nature of the skills involved.

In spite of the diversity among theoretically linked definitions, most explanations of the processes involved in comprehension can be classified along a theoretical range which extends from simple behavioral models (i.e. stimulus - response) to those which advocate more internal-mediational processing on the part of the reader. Cleland (1966) after reviewing a number of theories on the nature of comprehension concluded, "There is no universally accepted definition of comprehension but rather each one of us must formulate

his own definitions. It is imperative that this be done as our teaching will always reflect our concept of this activity" (p. 21). For the time being, it may be that the teaching of comprehension skills should be based on a functional analysis of the skills required for specific school tasks. This is particularly relevant because although educators use a variety of comprehension techniques in the classroom, they generally do not understand comprehension from a concrete remedial perspective nor do they define their techniques in terms of specific outcomes. Therefore, remedial procedures have tended to be inefficient, lacking in operational meaning, and unrelated to the skill requirements of many school tasks.

Recently, an eminent reading researcher made the desperate statement that "we cannot reject our present procedures for teaching reading comprehension but we must voice grave doubts about their efficacy" (Bormuth, 1970, p. 360). Some of the most advertised and widely used methods and materials are not the product of tested theoretical positions but rather have grown out of various assumptions and opinions about reading. Similarly, practitioners frequently operate solely on an intuitive level in the treatment of comprehension problems. Davis (1972), commenting on research trends in the investigation of reading comprehension, noted that "During the present century, innumerable writers have presented analyses of the processes and

skills thought to be involved in reading comprehension. The characteristic that most of the analyses have in common is a lack of association with any specific experimental data that provide empirical support for them" (p. 631).

Research into the skill components of reading comprehension has concentrated on a few very diverse areas. The earliest studies were focused on identifying critical aspects of the comprehension process through an analysis of reader performance on certain types of reading tasks. Thorndike (1917) reported the first systematic analysis of comprehension after studying the errors which students made while reading. Subsequently, several other researchers (Carroll, 1927; Richards, 1927; and Albright, 1972) also studied comprehension from an analysis of reader errors and from these findings several broad categories of skills were identified as essential components of the comprehension process. That is, comprehension was determined to be based on such global skills as verbal reasoning activity, knowledge of word meanings, ability to group facts, ability to follow syntactical structure, etc. Pettit and Cockriel (1974) in a review of the early research literature concluded, "Even though there is disagreement over the specific types of comprehension skills, the majority of studies have found reading comprehension to be composed of two broad categories at the very least: literal comprehension and inferential comprehension" (p. 64).

Other investigators have attempted to define

comprehension in terms of the skills actually measured on reading comprehension tests. According to Jenkinson (1970), "Until the midfifties the most fruitful area of research investigation was the application of factor analysis to various tests of reading comprehension to determine what factors were being measured" (p. 179). Although the types of skills identified were specific to the tasks investigated, they generally seemed to be testing abilities similar to those evaluated by intelligence and achievement tests (Auerbach, 1971; Esposito, 1971).

In a study of the comprehension of literary passages, Harris (1948) found that the variance of scores could be explained by the single factor of "general verbal facility." Similarly, Holmes and Singer (1966) found that the factor that accounted for most of the variance of 56 reading variables on the high school level was, "general verbal knowledge." Davis (1944), on the basis of a comprehensive survey of the literature, identified nine categories of basic skills of reading comprehension. On a subsequent measurement of these skills it was found that the greatest part of the variance could be accounted for by "word knowledge" and "reasoning" factors. In general, these early efforts did identify some skills associated with particular comprehension tasks, but the findings were specific to the measures examined and not necessarily reflective of the general skill competencies required for processing a variety of verbal materials.

Models of Reading Behavior

A shift in emphasis occurred during the fifties when attempts were made to examine the "process" rather than the "product" of reading comprehension. This process stage led during the sixties to the construction of a number of models to examine this phenomena. According to Pettit and Cockriel (1974), "A large number of researchers (Singer, 1965; Fagan, 1971; Simon, 1971; Davis, 1972) have investigated aspects of reading comprehension and devised models, theories, constructs, and taxonomies. Although there is little agreement as to the types of skills considered essential for language comprehension to occur, most theorists seem to agree that comprehension is composed of some kind of hierarchy of skills" (p. 64). Since these early classification models were derived primarily from broad subjective analyses or analyses based on only a few isolated studies, they did not easily lend themselves to empirical validation.

In spite of the many attempts at developing an integrated system for understanding comprehension, there continues to be no general theoretical agreement regarding the skills or the cognitive processes involved. Harker (1973), after an extensive evaluation of reading comprehension models, noted that there are currently only fifteen such models in existence. He concluded that "Although these models can be evaluated in the abstract, the variety of behaviors presented makes any comparative evaluation

impossible" (p. 26). Other researchers (Tuinman and Blanton, 1971; Chapman, 1969; Davis, 1972) have suggested that the most apparent shortcoming of existing models is their lack of empirical validation. The current models seem to approach comprehension from different perspectives and include a wide range of behaviors, many of them representing quite different phenomena under the term "comprehension." Aside from lacking heuristic value, these models tend to be fully as complex as the behaviors they are attempting to explain. Rystrom (1970) noted that although each of the current comprehension models considers an important dimension of the comprehension process, no one of them can be readily translated into strategies which a classroom teacher might use in teaching a child to read more effectively.

Although each explanation of reading behavior has met with a variety of criticisms and, as yet, no one of them emerges as a simple theoretical extension of the real world, the fact remains that without some theoretical structure an orderly system of data collection is impossible. Guthrie (1973) has observed that "models have not been extensively used for the study of reading processes in poor readers. Rather the approach has been to compare normal and disabled readers on a number of psychological tests to attempt to identify the causes of reading disability by locating cognitive processes on which normal and disabled readers differ" (p. 9). It may be that this approach is appropriate for

some types of reading problems, but it is based entirely on a "deficiency" assumption (i.e., poor readers are deficient in some skill necessary for adequate comprehension) and therefore offers only a limited explanation of reading difficulties. However, when more comprehensive models have been employed the research has not been consistent or extensive enough to yield much validating information. In this respect, a primary problem of most current explanations of reading behavior is the lack of psychometric data which consistently supports any single approach. Moreover, there has been little effort directed at integrating individual explanations into a more inclusive conceptual framework.

One promising line of investigation is that which has been generated by the Wiener and Cromer (1967) model. These authors have attempted to provide a conceptually integrated explanation to account for many of the phenomena subsumed under the term "reading problems." From a straightforward analysis of previous definitions of reading behavior, these authors have identified some of the confounding issues and have presented a comprehensive system for viewing reading disorders which has both remedial and heuristic value. Since this view of reading behavior forms the theoretical basis for the present research, the remainder of this section will focus on a more complete discussion of the etiological and remedial implications of this model.

One issue which the authors have attempted to clarify

is the difference between "identification" and "comprehension." According to this model, reading is defined as a two-step process involving first identification (decoding) and then comprehension. The assessment of identification is restricted to an evaluation of how words are said while comprehension is assessed by some measure of the reader's understanding of the contents. The failure to demonstrate adequate identification skills can be regarded as a reading problem but difficulties in comprehension are not as easily diagnosed. While poor readers generally do not comprehend as well as good readers, it is recognized that there are a variety of explanations used to account for such difficulties (e.g., restricted language, restricted experience, limited intelligence, or combinations of these variables). Although the authors acknowledge that even at the word identification stage some awareness of meaning is essential, they suggest that the comprehension process should be examined independently because there are many "word callers" who are unable to understand what they are reading.

This model proposes at least four explanations to account for the major etiologic factors underlying difficulties in reading comprehension. Briefly, reading difficulties can be accounted for by 1) a defect, which generally involves some type of sensory-physiological factor such as deafness, brain damage, etc.; 2) a deficit in some prerequisite skill such as phonics, word attack, etc., where restoration of the

missing skill is assumed possible; 3) a disruption where the difficulty is attributed to interfering factors such as anxiety, inattention, etc., and the disruption must be removed to fully restore functioning; or 4) a difference in the subject's typical mode of responding and that which is required by the reading task. In this case either the material should be changed to correspond to the subject's mode of functioning or the subject must change.

Although each etiologic category implies a particular kind of remediation, it is possible for a reader to demonstrate problems in more than one area. Thus, a child could demonstrate severe reading problems because he is both unmotivated (a disruption) and lacking in basic phonetic skills (deficit). Therefore, remediation would involve removing the disruption as well as teaching the child in the area of his skill deficit.

Although this model is quite simplistic, it has proven useful because it is specific enough to be empirically validated and yet, at the same time, it has the potential of providing valuable information concerning functional differences among the various types of readers. Specifying what these differences are should better enable us to determine what is necessary to help the poor readers perform more like good readers. Thus far, follow-up research of the Wiener and Cromer model has centered on the difference and deficit poor readers. While this research has offered a partial

validation of the authors' model and has proven very encouraging from a practical-remedial perspective, additional research is necessary to logically extend the present findings and to further validate the model in terms of the other types of poor readers.

Summary

The material discussed thus far suggests that "reading comprehension" is, as yet, a relatively poorly understood concept. It has been defined in a variety of ways with little apparent theoretical or empirical consensus as to what skills comprise comprehension or how best to teach it. Discussions regarding the "nature" of comprehension are frequent but represent, for the most part, statements which can best be described as strictly opinion, untested hypotheses, or proclamations with little empirical support. There is, at this time, a clear need for theorists to operationally define variables to be investigated and to seriously attempt to validate current practices in the area of remediation. Many reading specialists have noted that both materials and remedial practices have little foundation in experimental data. While past research efforts have focused on taxonomic studies, model building, and remedial aspects of comprehension, the collection of studies thus far has been so diversified that it has not decisively contributed toward a meaningful understanding of the interacting variables.

Of central importance in the investigation of reading comprehension is the clear delineation of theories and models which can offer heuristic statements regarding the nature of the critical variables involved. However, in spite of the number of theorists who claim to offer comprehensive theories of reading comprehension, only a few qualify as "heuristic" models. From a review of the literature relating to explanations of reading difficulties, the Wiener and Cromer (1967) model was presented as offering a promising theoretical structure for examining both etiological and treatment factors. It was noted that this conceptual system incorporates many of the existing explanations for reading behavior into one conceptual framework which is both simple and comprehensive.

PART II

THE REMEDIATION OF COMPREHENSION DIFFICULTIES

Introduction

In recent years we have been inundated by resources and techniques to improve children's word identification skills. However, it is clear that there has been little parallel development in the area of reading comprehension. Since word identification is only one major component of reading, there is an apparent need for an increased emphasis on materials and strategies for improving comprehension. The more central problem arises when remedial methods, which typically stress the mastery of word identification or code-breaking skills, assume that once decoding skills are mastered, good comprehension will automatically follow.

As noted earlier, the question of how best to teach comprehension depends, to a large degree, on underlying notions as to what learner skills are most necessary for comprehension to occur. While the exact nature of comprehension remains a matter of continuing controversy, a working understanding for remedial purposes is necessary. However, thus far the diagnosis and treatment of comprehension problems has been vague and idealistic, perhaps due to the elusive meanings of the concepts involved. In any event, there are large numbers of children who demonstrate normal intelligence with an apparent adequate knowledge of

sight vocabulary and word attack skills, but who continue to fail in comprehension situations.

The literature over the last ten years has suggested many effective strategies for improving the comprehension of poor readers. Levin (1972) has observed that such research efforts can be classified according to two major approaches. That is, to enhance learning, researchers have attempted either to manipulate some aspect of the learner's behavior or they have attempted to modify the learning materials in some critical way. The following review will be presented according to these two general approaches with an additional discussion on the manipulation of reading behavior via incentives. The review is limited primarily to studies which have focused on remedial strategies useful for improving the verbal comprehension of school age children. Of central interest are those investigations which have attempted to help poor readers improve on their comprehension of prose materials.

Modification of Reading Materials

A large collection of studies has focused on the manipulation of various properties of prose materials to determine their effects on learning and comprehension. To render learning materials more memorable investigators have attempted either to impose some simplified organizational format on the materials or they have added various supplementary cues to help direct and organize the learner's

efforts. In investigations which have focused on modifications in the format and nature of the text, such variables as the syntactic and semantic aspects or the image evoking properties of the materials have been considered. Other studies which have provided "assisters" to the text have considered the addition of pre-organizing questions, shortened and simplified passages or pictures corresponding to the text. It has been assumed that such adjustments in learning materials are sometimes necessary to provide a more suitable match of reader skills with the skill requirements of the learning task. In this way problems resulting from skill deficiencies or those due to instructional mismatches can be minimized.

The following review will cover studies which have investigated modifications in the conceptual format of materials, the language structure, or the mode of presentation.

Conceptual Structuring

The types of conceptual aids generally employed have included both pre- and post-reading organizers presented in the form of an outline, a set of organizing questions, or a simplified version of the materials to be learned. These "assisters" are primarily aimed at providing the reader with

specific cues to facilitate conceptual organization of the verbal materials. Perhaps the best explanation of an "organizer" is offered by Ausubel (1968) who describes them as a "deliberately prepared set of ideas related to the materials that are to be studied to insure that relevant anchoring of ideas will be available to facilitate comprehension" (p. 268).

Although the last decade has produced some studies focusing on conceptual pre-structuring of learning materials, most of them have utilized older subjects and relatively difficult reading materials. Proger, Taylor, Mann, Coulson, and Bayuk (1970) have classified studies of conceptual pre-structuring into those which have investigated "advanced," "concurrent," or "post" organizational aids. However, the authors note that only a few isolated studies have been done in each of these areas and thus little has been established regarding the mechanisms at work on the potential range of application. Schnell (1973) in a review of research on the use of the organizer as it relates to reading comprehension concluded, "It appears that the research findings support the use of the organizer as a means of improving comprehension and retention of prose materials and that they can be generalized to learning from the reading of textbooks" (p. 170).

While many studies in conceptual structuring have only considered variations of the paragraph abstract type of

advance organizer, some researchers have investigated the use of pre-and post-tests to stimulate interest in the learning materials and provide meaningful feedback for the learner. Recent advances in conceptual structuring theory, particularly in terms of pre-and post-organizing questions, have also been connected with "mathemagenic" behavior proposed and investigated extensively by Rothkopf (1972, 1970, 1967). The term "mathemagenic" is a broadly inclusive label which refers to behavior that produces learning. While no attempt will be made to review the many studies concerning mathemagenic activities, a few comments on the nature of these investigations is relevant.

Rothkopf has called various learner activities mathemagenic activities, or rather "those behaviors that give birth to learning." Here he is referring to various learner dispositions such as attention, learning to learn, etc. In part, the experimental studies of Rothkopf and others (e.g. Frase, 1968, 1969; Frase and Washington, 1970; Swenson and Kulhavy, 1974; Miller, 1974) have been concerned with the control of mathemagenic activities via the use of adjunct questions and directions. This approach tends to shift the emphasis of remediation from the investment of resources in the development of instructional materials to investment in the instructional environment. Certainly, if learning materials contain more information than a student can process within a limited period of time, then the addition of

specific questions can direct and focus the reader's attention and stimulate rehearsal of critical material.

In a discussion of the importance of questions in learning, Frase (1970) notes that there are three characteristics of questions which can influence learning; i.e., their position in text, the contiguity of questions and related content, and the type of questions. From a general review of the literature he concluded, "The data suggest that mathemagenic behaviors can be viewed as components of an adaptive system in which these behaviors are modified by two kinds of inputs: 1) those that occur prior to encounters with the text, and 2) those that are characteristic of the text. Although there is little doubt that these variables affect the performance of the reader, we currently have only a limited understanding of the relationships involved" (p. 344). In a later review of studies with children, Frase (1972) suggested that even very young children are affected by certain organizational properties of text and that there can be marked differences between subjects from different sorts of populations (e.g. high SES and low SES) in terms of their ability to answer simple and complex questions.

It is also noted by McConkie and Rayner (1974), that recent research on the effects of questions appearing before, after, or throughout passages can be partially interpreted as research on reading strategies. What a person learns from reading can be influenced by the choice and

placement of questions. Carver (1972) has pointed out that much of the research on the effects of questions has used ambiguous instructions which have failed to influence the subjects' reading strategies as much as they might, had they been more specific and informative.

Although investigations into the conceptual structuring of learning materials have been implemented primarily with adult learners, these studies have revealed several critical problems in the study of the relationship of reader characteristics to the organization of the learning materials and the measurement of learning outcomes. While the relationships are not yet fully understood, the findings suggest that what is learned depends on variables involved in the total instructional setting rather than those simply associated with the learning materials (Rothkopf, 1972). The nature and quality of learning is at least partially dependent upon the effects of different types of organizational aids (Ausubel, 1968), verbal instructions (Frase, 1968), or other orienting stimuli (Rothkopf, 1970). It is also noted that these organizational variables affect the performance of both young and old readers and seem to be differentially effective for different sorts of populations (Frase, 1972). The complexity of the relationships involved has certainly compelled researchers to be discriminating in terms of the scope of their investigations and cautious in generalizing their results.

Language Structuring

Another approach for improving the comprehensibility of learning materials is to modify the composition of the language variables such that they are better matched with the skills of the reader. While some authors (Schell, 1972) have noted that linguists may eventually make the most significant contribution to the improvement of reading comprehension, investigation in this area has been slow. A diversity of theoretical models have been proposed by linguists (Chomsky, 1965), psycholinguists (Goodman, 1970, 1966) and behaviorists (Skinner, 1957) to account for the development of the structural and syntactical elements of language. However, thus far, little has been done in the way of research to discover the nature of the relationship of comprehension with such factors as grammatical structure, syntax, and semantics. Briggs (1969) suggests that most reading programs are concerned primarily with broadening the semantic background of the reader and only incidentally are they concerned with the contribution syntactical skill can make to comprehension. Similarly, programs of remediation in comprehension stress improvement in such skills as vocabulary development, word attack, phonics, etc. However, few programs foster the use of context or semantic and syntactic elements even though syntax effects both the determination of word meaning and the interpretation of sentence meaning.

Martin (1969) observed that written English poses special syntactical problems and unless a reader can cope syntactically with sentence structure he cannot derive meaning from individual words. However, much of the evidence collected thus far suggests that there are large numbers of children who are good "word callers" but do not have a basic understanding of the syntactical structures through which meaning is conveyed (Bormuth, 1970). There is also evidence to suggest that deficiencies in syntactical processing can occur at beginning and mature reading levels. Denner (1970) in working with problem readers ranging from pre-school to fifth grade, concluded that "These readers all behave as if sentence meaning is a product of individual word meanings, whereas average readers seem to appreciate that words derive their meaning from the sentence context" (p. 886).

If it can be assumed that failure to synthesize separate words into a meaningful whole can be the result of a skill deficit, then remediation should focus either on appropriate skill building exercises or modifications in the syntactical structure of learning materials. In terms of skill building, some linguists (Lefevre, 1964) have suggested a variety of early training exercises for helping children to better deal with sentence patterns in order to minimize the risk of them becoming word callers. However, the research of Farnham-Diggory (1967) suggests that a state of "neurological readiness" may be necessary before conceptual synthesis can occur.

If this is true then early training in developing synthesizing abilities could be largely a waste of time with some children and therefore modifications of the learning materials may be a more feasible approach for improving comprehension.

In an effort to better understand how good and poor readers differ in the processing of verbal materials, Cromer and Wiener (1966) compared them in terms of their response-elaboration patterns. For both good and poor readers (classified according to the Durrell-Sullivan reading test) in the fifth grade, it was found that inappropriate responses were at least partly a function of the content and context of the stimulus conditions. However, poor readers discriminated and elaborated cues differently than good readers and responded to the material in a more idiosyncratic manner. Poor readers also made less syntactic-meaning appropriate responses and more errors on affective content stories than did the good readers. It was concluded that a basic problem for poor readers is that their patterns of cue elaboration do not match most printed materials and thus they need to learn how to respond in a more consensual manner. In this respect it was suggested that either they engage in some form of verbal elaboration (i.e., repeating sentences read to them) or that the materials should be reorganized into different sequences to focus attention on context and informational cues.

There is also evidence that even at the college level, relatively poor readers demonstrate semantic and syntactic processing difficulties. Shaver (1971) investigated the use of syntactic and semantic cueing as employed in oral reading by poor reading college students. All subjects were classified as poor readers according to scores obtained on the Nelson-Denny Reading Test and then subdivided into those students with higher vocabulary scores and those with higher comprehension scores. Subjects read randomly ordered expressions of three types; i.e., sentences, semigrammatical strings, and ungrammatical strings. Miscue analysis indicated an interaction between reader type and the use of semantics and syntax in oral reading. Higher comprehension subjects used both semantics and syntax in oral reading, while higher vocabulary subjects used only syntax. Thus, while the higher vocabulary group had relatively better skills in word calling and more knowledge of individual word meanings, they were less successful in synthesizing the meanings of words when they are presented within the larger context of a passage.

However, the research of Cromer (1970) has suggested that college level students who are relatively poor in comprehension because of difficulties in inputing what is read, can improve in the direction of good readers if the material is pre-organized. In this study junior college students were classified as either good or poor readers on the basis

of comprehension scores obtained on the Cooperative English Test of Reading Comprehension. Poor readers were then subdivided (according to the Wiener and Cromer model) into those with primary difficulties in decoding (deficit) and those with primary difficulties in organizing their reading input (difference). Subjects were then compared on a comprehension task in which the reading materials were presented either in predetermined phrase groupings or in regular form. It was expected that changing the structure of reading materials would benefit only those subjects who had the necessary vocabulary skills, but exhibited comprehension problems due to difficulties in organizing their input.

As expected, when organization was imposed on the reading materials, the difference readers were able to comprehend as well as good readers. On the other hand, poor readers, with deficits in vocabulary did not profit from the phrase organizations. The results were interpreted as offering support for the difference type of poor reader and suggested that manipulations in the structure of reading materials are facilitative for subjects who read poorly for reasons other than vocabulary deficits. These findings have implications for the differential diagnosis and treatment of comprehension difficulties and suggest that readers who have not adequately learned to deal with written material in terms of meaningful units can be encouraged to do so if the reading materials have some pre-organization imposed upon

them by the experimenter.

A study by Weinstein and Rabinovitch (1971) suggested that the syntactic deficiencies of poor readers may be general language weaknesses which occur in auditory as well as visual language reception. Fourth grade students were classified according to the Gates Reading Test as either good or poor readers. The subjects learned, via a tape presentation (listening), some sentences which were syntactically structured and others which were unstructured. Rate of learning and retention of content indicated that both groups performed equally well on the unstructured sentences. However, the poor readers recalled much less material on the structured sentences, indicating that the facilitative effect on retention associated with syntactic structure in good readers was not evident in the poor readers.

The findings were interpreted as evidence that the superior recall of good readers is primarily a function of their attention to syntactic cues. On the other hand, it was suggested that the poorer readers perform the same on structured and unstructured materials because they have not yet learned to efficiently attend to syntactic cues. This is apparently true even though the materials are presented auditorially. It would appear that simply providing poorer readers with materials in a listening modality may not compensate for the more general problem which is their inability

to make use of information in the grammatical structure of a sentence.

In summary, the literature suggests that the syntactic and semantic characteristics and the general language format of reading materials clearly influence the quality of reading comprehension. For some readers, at both beginning and mature reading levels, difficulties in comprehension can be traced to deficiencies in the effective utilization of various structural cues of a sentence. Further, such "syntactic deficiencies" seem to be general language weaknesses which can occur in both the auditory and visual language channels (Weinstein and Rabinovitch, 1971). There is also evidence that problems in synthesizing individual word meanings or concepts can be related to difficulties in semantic and syntactic cueing and that such skills may be related to certain developmental factors (Farnham-Diggory, 1967). Since poor readers seem to discriminate and elaborate cues differently than good readers (Cromer and Wiener, 1966), remediation has focused on reorganizing reading materials in terms of more meaningful units. So far this approach has been effectively used for improving the comprehension of printed materials for "difference" types of poor readers (Cromer, 1970).

Mode of Presentation

It is frequently assumed that if a reader is unable to process printed materials then simply presenting these

materials via a listening modality will be sufficient to remediate the problem. In particular, for deficit poor readers, it may be that presenting verbal materials in an auditory modality is the most practical and efficient approach for improving language comprehension. Similarly, matching modality preferences with instructional strategies has been a consideration for learners with well established perceptual strengths. These and other issues relating to the efficacy of various modality modifications on learning continue to occupy much of the literature. However, the remedial value of presenting materials in alternative modes or attempting some form of intermodal matching depends on a number of variables relating to the general language skills of the learner.

Although children can demonstrate large differences in perceptual abilities (i.e., visual, auditory, or kinesthetic), such differences may not remain constant over time. According to Bissell, White, and Zivin (1971), "In addition to individual differences in sensory-modality preferences, there are developmental changes in the relationship among the sensory modalities. Most children progress from a preference for the kinesthetic modality during pre-school years to later preferences for visual and verbal modalities. There is also a progressive increase in extent of integration among the different sensory modalities" (p. 144). Similarly, Blanton (1971), in a review of the literature,

concluded that studies suggest that the auditory mode produces superior learning of verbal materials when compared to the visual mode in early childhood. However, as the child gets older the differences appear to diminish and no one modality is generally superior for learning verbal material. In addition to these developmental changes in perceptual strengths there is evidence that both auditory and visual processing skills can be improved with training (Schneyer, 1971; Kennedy and Weener, 1973; Duker, 1965). Therefore, while the existence of individual differences in modality preferences is not questioned, the relationship of such preferences to the learning of verbal materials is difficult to predict for individual readers because of its continually changing nature.

Over the last few years several investigators have attempted to identify the preferred modality of readers and then have devised instructional programs to match with these preferences. Typically, these studies have classified learners according to preferences on the basis of performance on a variety of auditory or visual measures (e.g., Illinois Test of Psycholinguistic Ability, Learning Methods Test, Wepman Auditory Discrimination Test). The subjects investigated have ranged from first grade to college age and the tasks employed have involved reading recognition (Freer, 1971), vocabulary development (Bruininks, 1969), retention and recall of new words (Waugh, 1973) and the teaching of

reading (Robinson, 1972).

Although the bulk of modality studies has not offered a consistent pattern of findings to support the interaction of learning modalities with reading instructions, the lack of persuasive evidence is more than likely due to methodological difficulties in the studies reviewed (Blanton, 1971). A critique of the literature by Lilly and Kelleher (1973) suggested that studies which have used an aptitude-treatment interaction design generally have classified subjects according to scores on standardized tests which are of questionable validity for determining auditory and visual learning styles. As well, the treatments employed in these studies, while labelled "auditory" or "visual" have usually differed along dimensions which are much broader than the modality dimension.

Bissell et al. (1971), in a discussion of the literature relating to visual and verbal thinkers, observed that the existence of large individual differences in sensory modality preferences certainly suggests that instruction should be sequenced in specific ways for different kinds of thinkers. Once again it is noted that better methods are needed for assessing sensory modality strengths and that a distinction should be made between "preferences" and "strengths" in sensory modalities. Learners can demonstrate high skill strength in one or another modality and yet habitually prefer to rely on a modality which has a

relatively low skill strength. Thus, it seems that determining only a child's ability pattern does not provide all the information necessary for designing curricula that take maximum advantage of individual differences in sensory modalities. Such testing should be accompanied by determination of individuals' preferences in modality usage.

Sticht (1972) examined the relationship of reading ability to preference for learning by listening. The author conducted a survey of 400 adult men in the army. These subjects were tested for reading ability and then asked their modality preference when learning. The results indicated that subjects with the poorest reading ability tended to prefer learning by listening. It was suggested that while these data clearly indicate that many poorer-reading men prefer to learn by listening rather than by reading, the question remains as to whether or not they actually learn better by listening.

Two earlier studies by Sticht have suggested somewhat conflicting findings. In one study (Sticht, 1969) the data indicated that adult men who are poor readers learned equally poorly by listening as by reading. In agreement with Weinstein and Rabinovitch (1971) these findings suggest that some comprehension problems simply reflect a disability in language processing which prevails in spite of modality manipulations. Other data by Sticht (1971) have suggested that poor readers can indeed comprehend more when listening

than when reading, particularly when the primary difficulty is in decoding and not in the processes of comprehension per se. It seems likely that both explanations offer valid interpretations for comprehension problems.

Although the most common classroom strategies for teaching children depend, in large part, on reliance of the verbal modality, the possibilities offered by a multisensory approach have been explicitly or implicitly recognized by some (e.g. Montessori preschool programs). Bursuk (1969) compared a remedial reading program that used a combined auditory-visual approach with a program that used only a visual approach. Both programs were designed to improve reading comprehension of adolescent retarded readers who differed in their "preferred" sensory mode of learning (as measured by discrepancies between reading and listening skills). The results indicated that when modality strengths were not considered, a combined approach was more effective than a visual approach alone for improving comprehension. However, for subjects with visual strengths, a visual approach was more effective for improving comprehension. This suggests that remedial programs aimed at improving comprehension should consider either some form of intermodal matching (i.e., ability with remedial approach) or when modality strengths are unknown or unestablished a multisensory approach would likely be the best.

A study by Cohen (1968) has offered some encouraging

support for the use of a predominantly auditory approach in improving the comprehension and word skills of disadvantaged children. Teachers in an experimental group read a story every day for a period of one school year to 155 second grade students characterized as "culturally deprived." These teachers were also trained in various story-reading techniques and provided the children with accompanying activities for the materials read. The results of pre and post testing, using the Metropolitan Reading Achievement Test, revealed that the improvement of the experimental group over the control group was significant in vocabulary development, word knowledge, and reading comprehension. It seems that, even when modality preferences are not considered, very deprived students can overcome some profound handicaps in reading and language development if presented with alternative modes for learning.

In a follow-up of the Wiener and Cromer model, Oakan, Wiener, and Cromer (1971) investigated the interaction of reader type with mode of presentation. In this study the comprehension of good and poor readers (classified according to comprehension scores obtained on a standardized reading test) in the fifth grade was compared for material presented visually and auditorially, and under conditions of good and poor input. That is, both the quality of input (identification) and the organization of the materials were systematically varied.

When good auditory input was provided (identification) it was found that poor readers comprehended the most under a listening condition while for good readers comprehension was best under a reading condition. The results were interpreted on giving support to the notion that all poor readers do not necessarily have general deficiencies in language comprehension. In some cases, the comprehension difficulties are due primarily to the manner in which the reading input is organized. Therefore, presenting appropriately organized materials within a listening modality is sufficient to remediate some of the problem. In this case, the poor readers performed as well as good readers when they were able to listen to the passages. These results as well as those of Cromer (1970) and Sticht (1971) provide support for the existence of poor readers who demonstrate comprehension problems either because they cannot adequately organize their reading input (difference) or because they cannot decode the words (deficit) when presented in visual form.

In summary, modality studies have generally produced mixed and frequently contradictory results and taken as a whole this body of research lacks the consistency to draw reliable conclusions for remedial purposes. However, in spite of the apparent problems with previous research, the data collected thus far suggest that children can demonstrate large differences in perceptual abilities but because of certain developmental and/or experiential factors

these differences may not remain stable over time (Bissell et al., 1971). As well, studies investigating the relationship of learning styles to treatment strategies have also failed to provide evidence of a consistent relationship. It was cautioned, however, that better techniques for assessing modality strengths and devising treatment strategies are necessary before the data can be reliably evaluated (Blanton, 1971; Lilly and Kelleher, 1973).

The literature suggests that subjects with severe reading problems are likely to "prefer" learning by listening (Sticht, 1972). However, the comprehension problems of some of these readers may be attributed to more global difficulties in the comprehension process rather than deficits in decoding or problems in organizing input (Weinstein and Rabinovitch, 1971; Sticht, 1969). Therefore, presenting learning materials in a listening modality will not be sufficient to remediate the general language comprehension problems of these types of readers. On the other hand, some literature has suggested that when modality strengths are unknown or unestablished a multisensory approach can be the most effective teaching strategy (Bursuk, 1969; Bissell et al., 1971). In other instances, when subjects demonstrate some form of language deprivation, problems in organizing reading input, or clear deficits in reading skills, a predominantly auditory approach can be remarkably effective for improving language comprehension (Cohen, 1968; Oakan et

al., 1971). Therefore, at least some poor reader types (difference and deficit) would be expected to perform markedly better if presented with verbal materials in a mode which minimizes their skill problems.

Summary and Conclusions

The literature just presented has suggested that there are several ways in which verbal materials can be modified to make them easier for poor readers to understand. In this section three major approaches for structuring learning materials were identified and discussed under separate headings. The first technique refers to the "conceptual structuring" of verbal materials and involves adding some form of instructional assistance to more efficiently direct the reader's efforts in understanding what is read. The literature presented clearly suggests that the nature and quality of learning is at least partially dependent upon the effects of a variety of organizational aids, verbal instructions, or other orienting stimuli. In general, what is learned seems to depend upon how the learning materials are presented and therefore manipulations of various components of the instructional setting (e.g., materials, questions, pre-learning instructions, etc.) can significantly affect the learner's performance.

The second area discussed related to those studies which have investigated the relationship of language structure to reading comprehension. The data presented support

the existence of readers who demonstrate a general weakness in effectively attending to syntactic and semantic variables of printed or spoken language. Such problem readers can have adequate decoding skills and yet be unable to comprehend either because they organize their reading input in a non-meaningful fashion or because of a more general deficit in language comprehension (e.g. internal processing or association difficulties). It was suggested that, for readers who as a result of their style of reading are unable to synthesize individual word meanings, some type of imposed organization of the reading materials can facilitate comprehension. In particular, it was noted that verbal materials can be pre-organized such that they compel the reader to attend to groups of words as units of thought rather than individual words.

A final consideration in the present discussion focused on the relationship of learning with various modality factors. Although the research, to date, has offered many conflicting findings, it was noted that children can demonstrate large differences in perceptual skills and that such differences are likely to interact with instructional strategies. Poor readers tend to prefer learning by listening but presenting materials in an auditory mode will not necessarily remediate comprehension problems. For some readers general deficiencies in language processing will occur in spite of modality changes. However, for other readers with poor

decoding skills (deficit) or those with organizational problems (difference), the presentation of verbal materials via a listening modality should provide the best opportunity for them to adequately process learning materials.

In general, the data have suggested that prior to developing a remedial strategy, one must first have some understanding of individual differences in learning styles. The trend toward differential diagnosis and treatment of reading problems has been a central concern of the Wiener and Cromer (1967) model and although additional validation is necessary, the evidence collected thus far is convincing with regard to the existence of characteristically different reader types.

Modification of Reader Variables

Assuming that comprehension does, indeed, involve complex organizational strategies and that good and poor readers demonstrate general differences in these strategies, then identification of the nature of these differences should provide insight into some of the organizational skills necessary for comprehending what is read. In particular, if poor readers can learn to incorporate some of the reading habits of good readers, then perhaps differences in reading comprehension can be reduced. A concern of the present research is the investigation of reader strategies which can induce the reader to process verbal materials in a manner which facilitates organization and retention of the content. The following presentation explores primarily two

subject-generated mediational strategies known to be effective for improving the comprehension of poor readers, i.e., verbal and visual elaboration. Once again, it is not the author's purpose to provide a general review of the literature but rather the focus is on those studies which have relevance for the comprehension of prose materials.

Verbal Elaboration

Verbal elaboration, also referred to as "vocalization," "rehearsal," or "verbalization," is a subejct-generated organizational strategy used for facilitating the learning of verbal materials. In this strategy the reader simply learns to monitor his own reading and make his own connections through some form of verbal rehearsal. The purpose of this technique is to help the reader reach the same level of competency of interpretation with printed language that he already possesses with spoken language (Laurita, 1972). Although there are a variety of procedures used to achieve this end, the focus is generally on improving the reader's awareness of the consistent structural relationships that exist throughout language at all levels and not simply with isolated words.

When used as a training procedure, the teacher can actively participate with the reader to provide corrective feedback regarding his actual reading skills and key words can be discussed in terms of their structure and the context in which they appear. Comprehension questions can also be

critically reviewed along with the precise procedures to be used in obtaining the correct answers. In this way the reader can be shown how to scan for specific information and how to develop a set of operational procedures for answering main idea and sequence questions. According to Laurita (1972) rehearsal is one procedure which has proved to be extremely useful with numerous cases of reading comprehension problems, including those with both moderate and severe involvement.

It has been postulated that spoken rehearsal provides auditory and articulatory cues necessary for effective processing of verbal information (Levin, Ghatala, Wilder and Inzer, 1973). In terms of verbal discrimination learning, several investigators (e.g. Carmean and Weir, 1967; Wilder, 1971) have demonstrated the facilitative effects of simple spoken rehearsal. However, this technique would seem to have limited effectiveness for the learning of prose materials by readers with serious deficits in reading or vocabulary skills. Similarly, for readers who are primarily word callers (e.g. difference) or those with syntactical deficiencies, this technique would not seem to offer any advantage in terms of helping to improve the quality of input or organization. However, if some assistance via corrective feedback or pre-organization of reading materials were presented, then perhaps these types of poor readers could also benefit from a verbalization strategy.

Some literature has suggested that comprehension of verbal materials is best accomplished when it is actively planned for within the overall rehearsal procedures. According to Bobrow and Bower (1967), experiments on incidental learning have shown that recall is excellent when the learner is set to process a sentence in different ways designed to promote comprehension of its meaning, whereas equivalent exposure to or mouthing of the words in sentences with little reader involvement produces relatively little recall. Although the results of investigations so far have accentuated the importance of subject-generated mediational strategies in children's learning, the most effective strategies appear to be those which insure some degree of meaningful involvement on the part of the learner (e.g. verbal elaborations, summaries, critical reviews, etc.) as opposed to simple verbal rehearsal.

Visual Elaboration

At present there are two forms of visual elaboration which have been distinguished in the literature, i.e., "induced" and "imposed" (Levin, 1972). Induced imagery refers to instructions, supplied by the experimenter, to create visual images of what is read, whereas imposed imagery refers to pictures which accompany the reading materials. Although both types of visual elaboration have been utilized to facilitate comprehension, imposed imagery (e.g. the use of pictures) is a strategy which focuses on

the manipulation of learning materials rather than manipulation of reader strategies. Therefore, discussion of imposed imagery belongs more appropriately within the first section of this review (i.e., Modification of Reading Materials). However, because it is a form of elaboration which is related to visual imagery it will be briefly discussed below with the major portion of subsequent literature devoted to a discussion of induced visual imagery.

Imposed Imagery--The use of pictures as adjunct aids and prompts for reading materials is a practice frequently employed, particularly at the earlier grade levels. It is assumed that pictures can be helpful for building background for a story, introducing the meaning of new words or prompting recognition of printed words. In fact, one of the primary reasons given for using pictures is that they serve to organize the context of a passage and thus increase the comprehension of verbal materials. However, there is conflicting evidence regarding the efficacy of such procedures, particularly in terms of their facilitative effects on reading and language comprehension.

Samuels (1970) reviewed studies in which researchers had investigated the effects of pictures on learning to read, comprehension, and attitudes. In particular, the author gave preference to those studies in which pictures were used as adjuncts (i.e., the text could be comprehended even if the pictures were removed). He concluded, "The bulk

of research findings on the effect of pictures on acquisition of sight vocabulary was that pictures interfere with learning to read. In addition, there was almost unanimous agreement that pictures, when used as supplements to the printed text, do not facilitate comprehension" (p. 405). In general, the findings suggested that if a picture is to enhance comprehension, it must convey information that is relevant to the questions asked on a test. However, it was noted that one secondary advantage of adjunct aids such as picture illustrations is that they have a certain emotional appeal for children and thus tend to facilitate the development of positive attitudes toward reading.

More recent research has suggested that when pictures are used to augment the oral presentation of a passage they are likely to be facilitative for some poor readers. Katz and Konwer (1971) presented stories orally to high and low SES subjects who were similarly assumed to differ in reading achievement. Story passages were read to subjects in the company of either regular printed sentences or line drawings which appeared in sequence as each sentence of the story was read. For the better readers, performance was the same whether print or pictures accompanied the text. However, for the poor readers, when the story was accompanied by pictures, performance was as good as that of the better readers. Although good and poor readers differed only slightly in comprehension when pictures accompanied an

auditory version of the story, it is not clear whether the oral condition alone could have produced the same results for the poor readers (as in the Oakan et al., 1971, study).

A replication of the above study was conducted by Harris and Rohwer (1974). The authors used the same stimulus passages with the addition of an oral condition, a print condition, and a pictures alone condition. The purpose was to more fully examine the relationship of pictures and printed text to comprehension. Consistent with the earlier findings it was discovered that, for poor readers, the oral presentation of stories with adjunct pictures produced superior performance over oral alone. Therefore, it seems that pictorial representation of text is facilitative for some poor readers when the text is presented auditorially, but that this relationship may not hold under conditions of printed text. It may also be that a condition of pictures alone is not sufficient, in and of itself, to facilitate comprehension for poor readers. Levin (1973) found that pictorial presentation alone was not helpful for poor readers, particularly those with organizational input problems (difference). It was suggested that some kind of linguistic accompaniment to the pictorial sequence may be required for optimal comprehension to result.

In summary, the use of pictures to accompany printed materials can be viewed as a form of visual elaboration which is imposed upon the learner to facilitate comprehension

of verbal materials (Levin, 1972). While the data are somewhat inconsistent, there is evidence to suggest that poor readers can improve in comprehension if adjunct pictures accompany the auditory presentation of stimulus materials (Katz and Rohwer, 1971; Harris and Rohwer, 1974). However, when other materials are involved (e.g. printed), the effects are not as certain since the efficacy of this procedure is dependent upon certain characteristics of the reader as well as the form of linguistic accompaniment used (Levin, 1973; Harris and Rohwer, 1974).

Induced Visual Imagery--Visual imagery is a reader-generated or experimenter induced strategy which is rapidly gaining credability as a worthwhile procedure for improving comprehension. In this procedure, the subject is instructed to make up "mental pictures" corresponding to what is going on in the text. It has been postulated that this form of elaboration facilitates comprehension because it represents text information more simply and provides the reader with an effective organizational strategy (Paivio, 1971). At present, an assortment of literature exists which establishes the efficacy of this procedure for both associative and complex verbal learning tasks. In general, the literature consistently shows that subjects who are induced via pre-learning instructions to generate images of the things read, outperform subjects left to their own devices (Bower, 1971; Paivio, 1969; Bugelski, 1970). Although the

remedial value of this strategy is well established for some purposes, the dimensions of its applicability for different types of readers and different reading materials has yet to be fully explored.

Research which has focused on the usefulness of visual imagery with differing types of prose materials has suggested that verbal materials which are relatively more image-evoking are better learned than materials which are less image-evoking (Paivio, 1971). The same appears to be true for image-evoking sentences and image-evoking passages (Cunningham, 1972; Yuille and Paivio, 1969). However, the research of Paivio (1971) also suggests that the elicitation of imagery is likely to be partially dependent on the concreteness of the to-be-learned materials. It seems that with concrete materials subjects report using imagery strategies more frequently than with abstract materials. Similarly, Paivio (1970) has reported data which suggest that abstract sentences have longer imagery latencies and result in inferior recall of semantic meaning as compared with concrete sentences. In sum, the data suggest that visual imagery may be most useful for improving comprehension when the materials are of a concrete nature and the text is such that it naturally evokes mental images.

In relation to the types of tasks investigated, imagery has been employed successfully for paired-associate, prose, and rote types of learning (Bower, 1970). However, the

effect of imagery instructions on prose-type reading tasks is not nearly as consistent as it is in rote-learning tasks (Levin, 1973). Levin and Divine-Hawkins (1974) suggest that for materials which already possess an inherent structure (e.g. prose materials), the addition of an organizational strategy such as visual imagery is less likely to be facilitative than for those which do not (e.g. rote-learning materials). The authors note that "Even though visual imagery may be an effective comprehension strategy, it may not be an overly effective reading (prose) comprehension strategy (p. 24).

In addition to the characteristics of learning materials and the types of tasks employed, imagery production is also dependent upon certain reader variables. The literature suggests that problems in employing visual imagery as a reader strategy have been attributed to various developmental factors, processing difficulties, or other deficits in prerequisite skills. Similarly, image production has been found to be contingent upon various experiential factors as well as the quality of pre-experimental instructions. To determine the efficacy of imagery as an organizational strategy at various developmental and/or skill levels, investigators have generally compared different populations on their facility in using this procedure.

There is some evidence that younger children (below age 7) may have difficulty producing dynamic images (Montague, 1970; Wolff and Levin, 1972). To more precisely assess the

developmental course of verbal and imaginal strategy production, Levin, Davidson, Wolff and Citron (1973) compared second and fifth graders in their use of imagery in a paired associate learning task. In both grades it was found that children benefitted from the imagery strategy to approximately the same degree. Overall, the data suggest that children as young as age seven can profit from an imagery strategy but that below this age they may have difficulty producing covert dynamic images.

Levin (1973) examined the comparative effectiveness of visual imagery for three different types of readers. Fourth grade students were classified according to the Wiener and Cromer model as either difference, deficit, or good readers. Both the difference and the deficit groups were diagnosed as poor readers according to overall comprehension skills (obtained from Iowa Test of Basic Skills) and the study focused on strategies for improving these skills. The treatments involved reading a passage, reading and imagery (induced), or looking at a pictorial representation of the story (imposed).

As predicted, the results indicated a "reader type" by treatment interaction. It was found that reading with visual imagery was relatively more facilitative than reading alone for the good and difference readers. However, instructions to use visual imagery did not benefit the deficit poor readers. It was concluded that imagery instructions

benefitted only those students with adequate basic reading skills who were in need of an organizational strategy. According to Levin (1973), "These data extend the difference-deficit distinction from experimenter-provided organizations (Cromer, 1970) to subject generated organizations" (p. 23). It seems, that for subjects lacking the ability to read individual words, an imagery strategy is of no value, but for those with basic reading skills intact, the training of imagery production is a reasonable organizational strategy.

The research of Anderson and Hidde (1971) has suggested that aside from offering organizational advantages, imagery instructions can also induce the reader to process learning materials in a meaningful fashion, even if the intent "to learn" is missing. In this study college level subjects were asked to rate either pronounciability (based on repeating sentences aloud) or the imagery vividness of sentences (based on facility in forming images of the material read). On a surprise test for recall of as many sentences as the subject could remember, it was found that the imagery rating group recalled many more sentences and sentence parts (verbs and objects) than did the pronounciability rating group. The authors concluded that imagery instructions facilitate learning by causing subjects to process sentences in a meaningful fashion. It was suggested that simply reading

the sentences aloud (verbal rehearsal) may interfere with spontaneous semantic encoding and, in agreement with Bobrow and Bower (1969), some form of meaningful processing is necessary for comprehension to occur.

In a more general sense, pre-learning instructions (in terms of how learning materials are to be processed), can have significant effects on the type and amount of learning which occurs. For mature learners it is assumed that motivation and intent to learn are adequate and thus without much prompting these students would be expected to perform the necessary operations required to learn. However, this assumption does not hold for poorer learners where motivational and learning strategy factors may be a serious problem. In these cases, motivational problems can be minimized if the task requires some sort of meaningful processing as in the case of visual imagery instructions (Anderson and Hidde, 1971). On the other hand, strategies such as verbal rehearsal or imposed visual representation (pictures) of the reading text may not be meaningful enough to result in adequate processing, particularly if the subject is not appropriately pre-instructed.

Problems with pre-learning instructions have emerged from some of the recent research on imagery production, where it has been demonstrated that subjects sometimes process learning materials independently of experimental instructions. In this respect, developmental aspects of

comprehension strategies should be carefully examined, particularly because younger subjects are less likely to generate facilitative organizational strategies spontaneously (Rohwer, 1970; Levin, 1973). For subjects who are relatively unfamiliar or inexperienced in using visual imagery for verbal learning, simple pre-experimental instructions may not be sufficient to induce imagery production. Therefore, the quality of the visual imagery production is at least partially dependent upon various learner traits as well as the nature of the pre-experimental instructions.

Anderson and Kulhavy (1972) have demonstrated the importance of examining the reported incidence of visual imagery when evaluating the effects of imagery as a treatment strategy. In this investigation high school seniors were given a passage to read either with or without instructions to visualize what they were reading. Surprisingly, it was found that subjects given imagery instructions learned no more than those who were not. However, a post-experimental questionnaire revealed that more than one-half of the control group reported using imagery and about one-third of those instructed to use imagery did not. In addition, those subjects who reported having used imagery extensively recalled more of what they read than those who reported having used little or no imagery. Although the investigators concluded that subjects can learn more from a prose passage if they form images of things read, they cautioned

that for certain passages the tendency to employ imagery is inadequately controlled. Since one cannot be sure imagery has been induced by the simple preliminary instructions offered by the experimenter, conclusions as to the success of imagery as a learning strategy should be tempered with this understanding.

To improve the production of visual imagery, Lesgold, Curtis, De Good, Golinkoff, McCormick, and Shimron (1974) developed a training procedure which they have used with third- and fourth-grade children. Initially, these subjects were unable to profit from imagery instructions but after training in imagery production (12 sessions at approximately 25 minutes per session), they were able to perform substantially better on certain kinds of reading comprehension tasks. Primarily, the training procedure involved helping the child to understand what his mental images should consist of as he reads. After each passage the children drew a cartoon sequence (composed of stick figures) to illustrate the passage content. As time progressed an attempt was made to transfer the teacher-oriented criteria for cartoon adequacy to internal subject-generated criteria for undrawn mental images.

The research of Levin and Divine-Hawkins (1974) suggests that visual imagery may be induced more easily under a

listening condition as opposed to reading. In this study the effects of imagery on prose-learning were evaluated when the materials were presented in different modalities. Fourth-grade average and above-average readers were given prose passages via print or tape recording and under imagery and regular instructions. It was found that visual imagery was elicited more frequently under a listening modality than under a reading. These findings were interpreted as evidence that reading and visual imagery may be competing responses and that executing them concurrently is probably more difficult than attempting to image while listening. It was also found that nearly half of the subjects who reported the most frequent imagery came from non-imagery instructed conditions. This further substantiates the Anderson and Kulhavy (1972) results and suggests that, at least for average or better readers, the employment of an imagery strategy may occur spontaneously without instructional inducements.

Beyond simple modality manipulations, the effectiveness of an imagery strategy is also likely to be dependent on certain reader preferences with regard to style of learning. Levin, Divine-Hawkins, Kerst, and Guttmann (1974) examined how various differences in modality preferences affect the use of an imagery strategy. In this study fourth grade students were classified on the basis of whether they learned relatively better from pictures as opposed to words. Similar to the aptitude by treatment interaction noted in

the Levin (1973) study, it was found that certain learning modality by reading strategy interactions may also have to be considered. That is, children who did not learn appreciably better from pictures than from words (Lo P , Lo W) did not benefit as much from the imagery strategy as those who did (Hi P , Lo W). In fact, the findings indicated that imagery instructions may have been detrimental to the reading comprehension of Lo P , Lo W learners. It was suggested that such subjects may have developed alternative (non-imagery) strategies for successfully processing prose materials under natural conditions.

In summary, visual imagery has been demonstrated to be a useful strategy for both associative and complex verbal learning tasks (Bower, 1971). However, the efficacy of this procedure is contingent upon the learning materials involved, tasks employed, and certain reader variables. The data suggest that imagery is most useful for improving comprehension when the materials are of a concrete nature and the text is such that it naturally evokes mental images. For materials which already possess an internal structure, the addition of an organizational strategy such as visual imagery is less likely to be facilitating than for those which do not (Paivio, 1971).

In relation to reader variables, research has suggested that the ability to produce covert dynamic images may follow a developmental pattern (Montague, 1970; Wolff and Levin,

1972). However, it has been demonstrated that with proper training in imagery production, children who are initially unable to profit from imagery instructions can learn to do so (Lesgold et al., 1974). This finding is particularly relevant in terms of recent research which has suggested that subjects do not always behave as they are instructed to and for some subjects, pre-experimental training in imagery production may be a pre-requisite for appropriate imagery production (Anderson and Kulhavy, 1972).

In general, visual imagery has been found to be a meaningful form of verbal processing for learners with motivational, organizational, or learning strategy problems. It has been suggested that subjects who effectively employ this strategy are compelled to process verbal materials in a meaningful manner, and that other strategies such as verbal rehearsal probably do not force semantic encoding to the same extent (Anderson and Hidde, 1971). However, for printed materials, subjects with decoding and vocabulary deficits are likely not to benefit from an imagery strategy (Levin, 1973). This may not be true under a listening condition as there is evidence that when learning materials are presented auditorially, visual imagery is elicited more easily because of the elimination of decoding demands (Levin and Divine-Hawkins, 1974). In relation to modality considerations, the efficacy of imagery as a reader-generated strategy is likely to be dependent on modality preferences as well

as differences in styles of learning (Levin et al., 1974).

Summary and Conclusions

Studies which have investigated the modification of reader variables to improve reading comprehension have generally focused on inducing the subject to process learning materials in a more meaningful fashion. The present review was limited to pre-learning instructions which require the subject to perform visual and verbal elaborations of the reading text. It is assumed that these strategies can induce the learner to process verbal materials in a manner which facilitates organization and retention of the content.

The literature has suggested several forms of verbal elaboration ranging from simple "rehearsal" to more sophisticated elaborations of the text. In each of these procedures, it is assumed that rehearsing what is read improves comprehension because it provides auditory and articulatory cues for the reader and improves awareness of the structural and semantic relationships among words. However, some of these procedures do not necessarily require that the learner meaningfully process what he is reading. Therefore, in some cases it is possible for the subject to simply recite words without detecting meaning. In this respect the most effective reader-generated strategies are those which compel the reader to become meaningfully involved in the text of the reading materials. This is particularly

relevant for readers who have difficulties organizing their input or for those who are prone to simply read words without some form of meaningful processing.

Visual imagery is considered a subject-generated elaboration technique which can be elicited by pre-learning instructions. The data generally support the view that imagery is useful for improving the comprehension of prose materials, particularly for subjects in need of an organizational strategy. Primarily this technique induces the reader to meaningfully associate and organize the content of verbal materials. It offers the advantages of being a simple procedure which is useful for a variety of learning materials. Similarly, it is suitable for young and old readers with differing levels of skill competencies. Although the literature has suggested limited applicability for very poor readers, it is possible to modify learning materials (e.g. changing mode of presentation) in a manner which minimizes deficiencies in decoding or vocabulary skills and renders the materials more suitable for an imagery strategy. For readers who are inexperienced in producing visual images, there is evidence that these skills can be improved with minimal effort. It can be concluded that this procedure has well established remedial value for improving the memorability and comprehensibility of prose materials for a wide range of readers.

Incentives and Reading Behavior

The Wiener and Cromer (1967) model has postulated that one form of reading difficulty can be attributed primarily to factors which interfere with reading behavior and that such "disruptions" must be removed or reduced before adequate reading comprehension can occur. These interfering factors have been associated with various reader states such as "anxiety," "emotional" difficulties, and other "intrapsychic" conflicts which can significantly reduce reader performance. In particular, motivational factors are well known problems for some learners and without proper incentives efficient learning is seriously impaired.

It is possible for a learner to be deficient in some reading skill and consequently poorly motivated to attempt tasks associated with this deficit area. In particular, readers with very poor decoding skills are likely to be unmotivated to perform well on reading tasks because of a high probability of failure. In this respect motivational disruption operates jointly with skill deficiencies and remediation must focus on first removing the interference and then adding the missing skills. An interesting issue surrounding the disruption-deficiency assumption is whether readers poor in comprehension are primarily unmotivated learners who, with proper motivation, would perform as well as average learners. It may be that the central problem of poor readers, assumed to have either difference or deficit

problems, is actually motivational and that, with proper manipulation of incentives, performance would improve.

The following review is limited to those studies which have attempted to manipulate incentives to improve performance on reading tasks. Since it is not the purpose of this section to give a complete accounting of these techniques, only a sampling of these efforts is offered to provide some insight into the use of these procedures with poor readers. In addition, a brief discussion is presented as an introduction to some of the theoretical and practical considerations in the implementation of a reinforcement approach for school learning tasks.

Learning Versus Performance

A theoretical distinction is frequently made between "learning" (or competence), i.e., what a person knows, and "performance," i.e., what a person is willing to show us about what he knows at any particular moment in time. According to Deese and Hulse (1967), learning must always be inferred from overt performance but frequently organisms do not demonstrate what they have learned because the proper conditions do not exist to elicit the overt display of the learned behavior. This concept of "hidden learning" first arose from experiments by H. C. Blodgett (1929) who had found that if rats were given a number of trials in running through a maze when there was no food in it, they would almost immediately run through correctly once they found food placed there. Later E. C. Tolman (1932) referred to

this phenomenon as "latent learning" and suggested that while reinforcements or rewards affect performance they may have little or nothing to do with learning. Thus, the notion arose that learning can take place during unreinforced trials but may not be overtly demonstrated unless a reinforcer is introduced. In this sense it is possible for anyone to acquire knowledge without showing it, unless there occurs some appropriate occasion or need. Therefore, the teacher must be aware that knowledge gained by the learner may not always be evident under fixed operating conditions, but rather a change in incentive (upward or downward) may reveal a corresponding change in performance.

According to Bandura (1969), "Incentive theories of motivation assume that behavior is largely activated by anticipation of reinforcing consequences. Thus, in producing intellectual strivings in children who display little interest in academic pursuits, one would arrange favorable conditions of reinforcement with respect to achievement behavior rather than attempt to create in some ill-defined way an achievement motive." This view of learning, early demonstrated on a large scale by the programmed instruction movement, assumes that the failure of a learner to achieve the instructional objectives of a program reflects flaws in the program rather than inadequacy in the learner. However, according to Lipe and Jung (1971), "No one incentive theory provides a complete design for planning the most effective

use of incentives to induce learning achievement. Operant learning theories are perhaps the most relevant because they include the giving or withholding of immediate rewards and punishments" (p. 252).

Learning and Reinforcement

As regards the use of operant procedures, Skinner (1959) had demonstrated that it is possible to shape and maintain remarkably complex behaviors in both animal and human subjects through differential reinforcement and the principle of successive approximation. In terms of reading behaviors Bloomer (1966) notes that if one were to follow strictly the tenents of operational behaviorism the process of reading is an extinction process. No overt reinforcements are given for reading words as sentences except at early grades, unless we consider that such behavior as page turning or finishing a book is in fact sufficient reinforcement to sustain the process. While it is true that many good readers derive considerable non-overt reinforcement from the act of reading itself, the vast number of poor readers derive little or no reinforcement whatsoever.

Hewett (1967) presents a hierarchy of psychoeducational tasks which takes into account various reinforcement levels that correspond to the learner's "psychoeducational expectations." In this paradigm the nature of the reward varies with the developmental readiness of the child. The diversity of rewards employed, i.e., tangibles, task completion, etc., takes into consideration the complexity of the

individual learner's specific liabilities and assets. From this perspective, no assumption is made regarding the potency of a potential reinforcer except as it relates to a particular child's "psychoeducational" development.

While the old saying that learning is its own reward may apply to certain children in the classroom, the question remains as to whether the saying applies to all, some, or most children learning to read. Since the advent of programmed reading texts, it has been noted that many students continue to be unable to learn basic word recognition skills and fail to comprehend the materials studied. The ability of an individual to derive self-reinforcement from reading material depends on a number of variables directly related to the reader's skills and the difficulty of the reading materials. Where the material is too difficult or the reader's skills very poor, we find that the ability of the individual to "self reinforce" is lower than the amount of energy or frustration that he must exert to read. Therefore, the ability of an individual to reinforce himself while reading is directly related to his attention to the material and to his reading comprehension. If decoding and comprehension skills are very poor, then the act of reading difficult material would appear to have the basic components of an extinction process.

Aside from the development of programmed learning materials, the conscious application of reinforcement

principles for academic purposes has been limited to a scattering of studies offering little consistency in the types of problems studied or the populations utilized. In terms of those studies which have investigated reading- and language-related problems, the present author found nothing in the literature relating to the application of incentives exclusively to reading comprehension tasks. Similarly, the populations investigated varied considerably in terms of age and group classifications, i.e., delinquents, emotionally disturbed, college students, etc. However, most significant is the lack of effort aimed at the investigation of school age poor readers. Therefore, in spite of the apparent large gaps in research data, the following studies are fairly representative of the current state of research as regards the use of incentives in helping to remediate reading and language behaviors.

Selection of Incentives

According to Raygor (1965), "Early behavior research, while descriptive of the reading process, was not concise enough to allow practitioners to manipulate necessary variables to induce lasting changes in the reading process" (p. 225). More recently, however, the emphasis has been focused primarily on research variables which from a behavioristic perspective, have the most potential to affect performance. Representative of this trend is the generous amount of literature devoted to the treatment of types and schedules of reinforcers considered most effective for inducing change.

Given that performance is extensively determined by reinforcement conditions, the development and selection of an effective incentive system is of central importance. Hewett (1968) has suggested that the monetary value of a reinforcer is relatively unimportant to its value as a reinforcer, especially with younger children. Lipe and Jung (1971), in a thorough review of the literature on the incentives most frequently used within the school setting, consider a variety of reinforcers; i.e., material incentives, social incentives, knowledge of results, secondary reinforcements, and vicarious reinforcements. They concluded that although a teacher may want an incentive to be maximally rewarding as well as easily and inexpensively administered, this objective is complicated by the fact that individual tastes and interests vary from student to student and from day to day. Kennedy and Willcutt (1964) reviewed the literature on two of the most frequently applied incentives within the school setting, i.e., praise and blame. The authors concluded that while these are considered the easiest and most natural of social incentives to use in educational settings, students vary considerably in their responsiveness such that their potency cannot be predicted ahead of time.

It has been demonstrated that, given an appropriate incentive system, even very young children will engage in complex learning activities with sustained interest over

relatively long periods of time. As part of a program of research on reading, Staats (1964) and his colleagues presented programmed material designed to teach word and sentence reading to preschool children. When children were verbally praised for correct responses but offered no extrinsic rewards, they worked at reading tasks for 15 to 20 minutes, then became bored and asked to leave. When they no longer wished to remain in the situation, tangible rewards, consisting of candy, trinkets, and tokens were introduced. Under the influence of the positive reinforcers, made conditional upon reading achievements, the children's limited attention span suddenly expanded, and they worked enthusiastically at the reading task for 45 minutes and actively participated in additional sessions.

Another group of preschool four year olds performed the reading task under reinforcement conditions for two sessions, then the rewards were discontinued until the children would no longer participate, following which extrinsic incentives were again reinstated. During the initial reinforced sessions the children attended closely to the reading material and actively worked at learning new reading responses. However, when reinforcers were withdrawn the children's attention, participation, and reading achievements rapidly deteriorated.

For older students, it is often assumed that some form of "self-reinforcement" is likely to sustain interest and

achievement on difficult learning tasks. However, Bloomer (1966) has reported a series of experiments which have investigated this phenomenon as reflected in the performance of middle school children on cloze procedure materials. The data collected indicate that higher grade pupils confronted with material of extreme simplicity could not derive sufficient self-reinforcement from reading the material or completing the cloze exercises to comprehend at an appropriate grade level. It was concluded that while self-reinforcement is most frequently utilized by older students with established patterns of achievement, the presence of such self-initiated reinforcement is dependent on a number of variables including the difficulty level of the reading materials. Just as very difficult materials can present a problem for self-initiated reinforcement, so can very easy materials.

Some researchers have attempted to evaluate the comparative effectiveness of several reinforcers for improving performance in verbal learning tasks. McDonald (1970) reported a study which compared the effects of auditory, supraliminal (i.e., just above perceptual threshold) and written reinforcements on the vocabulary development of seventh and eighth grade pupils. In this case auditory reinforcement was defined as, "The teacher talking about a word for one minute via closed circuit television." There were four treatment groups, e.g., auditory reinforcement

alone; auditory and supraliminal reinforcement; auditory, supraliminal, and written reinforcement; and auditory and written reinforcement. The results indicated that written reinforcement added to teacher talk helped seventh and eighth grade pupils make greater gains with very difficult vocabulary words than teacher talk alone or teacher talk combined with supraliminal reinforcement. This study suggests that increased emphasis should be placed on the use of reinforcement techniques beyond just auditory reinforcement and that a combination of reinforcement techniques can be more facilitating than the application of only one type of reinforcement.

In addition to the type of incentive, the schedule of delivery is also considered critical in terms of certain performance variables. A study by George (1970) investigated the effects of different reinforcement schedules on reading performance of second grade pupils. The subjects were divided into three reading levels; above average, average, and below average and were randomly assigned to a fixed ratio, variable ratio, or no reinforcement group. Reinforcements consisted of red foil stars, either exchanged for pennies or candies. The results indicated that there was an interaction effect between reader type and reinforcement schedule. The data showed that above average readers in a classroom situation responded better with some type of reinforcement than they did with no reinforcement. They

also performed better with frequent reinforcement than with infrequent reinforcement. The below average readers responded least well to variable-ratio reinforcement, i.e., both the inconsistency of reinforcement and the knowledge of losing appeared to have affected the response rate. The author concluded that while fixed ratio reinforcement may increase the rate of responding and perhaps learning of faster students, it may also have the effect of discouraging the slower students in class. This investigation clearly demonstrates that many studies of reinforcement scheduling have limited generalizability to specific group situations and consideration should be given to possible aptitude (reader type) by treatment (reinforcement) interactions when designing contingency programs for a heterogeneous group of readers.

Language Remediation and Incentives

A few research efforts have emerged as part of a total long range program to investigate the application of "behavior management techniques" exclusively for language remediation purposes. For the past several years the faculty at the Reading and Study Skills Center at the University of Minnesota has published several studies reporting their attempts to manipulate reading rate and other relevant language behaviors (e.g., Raygor, Wark, and Warren, 1966; Wark, 1967; Wark, Kolb, and Tonn, 1968). These efforts have been structured in a rather straightforward operant paradigm. The contingency in most cases has been a confirming stimulus

signal given to the readers when they go above or below some specific criterion of rate. However, the work has been done, for the most part, with college students in a rather constrained laboratory situation. Following this line of research, Wark (1969) reports several case studies at the University of Minnesota in which skills such as reading speed, comprehension, and attention were improved through contingency contracting. These efforts, while somewhat limited in terms of the populations considered and the problems explored, do establish the effectiveness of operant techniques in producing some fairly rapid changes in reading behaviors of adult subjects.

A similar effort has been undertaken by Schaeffer and Schaeffer (1969) in which, over the past several years, the authors have been attempting to develop and implement a program for the retarded reader at the secondary level. The attempt is aimed at refining, revising and developing materials and procedures into a model secondary remedial program which can be replicated and used in a variety of teaching situations. According to the authors, the program utilizes operant conditioning techniques to teach decoding, develop vocabulary skills, increase comprehension skills, and shape scholarly behavior.

Most of the materials and all of the procedures have been developed in the classroom as a result of direct interaction with hundreds of students who are retarded in reading. In particular, decoding skills are

developed through differential aural reinforcement and the principle of successive approximation. These are presented through tapes and dittoes specifically prepared to develop word-attack skills. While the development of decoding skills appears relatively specific with regard to the skills specified and the reinforcements employed, the improvement of comprehension is more general and less tied into well defined behaviors. The authors note that, "To develop comprehension skills students receive guided practice in reading and responding to materials of increasing difficulty." While the procedures used to teach decoding skills appear to incorporate operant techniques, those of comprehension are much less specific and doubtful as regards their connection with a controlled operant paradigm. However, the program does appear to offer a promising attack on remediation of identification skills. The approach is also criterion referenced in terms of dealing directly with in classroom materials and learning tasks.

In addition to the application of operant procedures for the remediation of reading and language problems exhibited by relatively normal populations, some practitioners have achieved remarkable success when applying these same procedures to profoundly handicapped populations. Cohen (1968) worked with convicted delinquent adolescents with long histories of school failure to improve both reading and achievement test scores. Lovaas (1968) employed operant

procedures with autistic children and achieved notable success in developing language and speech behavior. Addison and Homme (1966) worked with severely educationally handicapped children on an Indian reservation and successfully used a technique of reinforcement smorgasbord to teach basic skills. While these and other investigations have demonstrated that incentives can be productively applied to facilitate the development of reading and language behaviors, these procedures have not been used extensively with very poor readers nor have they been applied directly to tasks involving reading comprehension.

In summary, it appears that for poorly motivated students, designing a more efficient learning environment may be a necessary prerequisite for adequate learning to occur. Since there are many readers who demonstrate serious skill deficits compounded with motivational problems, remedial strategies should consider the complexity of these factors in contributing to overall learning and performance problems. In connection with the Wiener and Cromer model it was noted that some reading difficulties can be attributed primarily to various motivational and attentional problems which disrupt and interfere with adequate learning. A related issue underlying much of the current literature in reinforcement research is whether incentives alone can remediate learning difficulties which are assumed to be caused by underlying academic deficits. It is possible that

poor readers with apparent difficulties in comprehension may perform poorly primarily because of motivational problems and not because of skill deficits.

The organized application of reinforcement principles was initiated with the advent of programmed instructional procedures. However, other research on the use of incentives for reading and language learning has been relatively scattered. The populations and the types of problems investigated have varied considerably and there is a noticeable gap in the investigation of school age poor readers. More recently behavioral research has focused on a number of environmental variables which have offered the most promise for affecting school performance. In particular, research has been devoted to investigating the efficacy of various types and schedules of reinforcers. The selection of appropriate incentives depends upon a number of reader variables including developmental factors, academic skills, and learner preference in terms of previous reinforcements (Lipe and Jung, 1971).

The data reviewed have suggested that with appropriate tangible incentives, very young children will engage in complex verbal learning with sustained interest and achievement over relatively long periods of time (Staats, 1964). Similarly for older children with either motivational problems or serious skill deficits, some form of external incentive may be necessary to overcome performance

problems (Bloomer, 1966; Lipe and Jung, 1971). Thus far, operant procedures have been successfully applied for remediating an assortment of reading difficulties for both beginning and mature readers (Wark, 1967; Schaeffer and Schaeffer, 1969). Such behaviors as reading rate, comprehension, attention, decoding, and vocabulary skills have been improved for both normal and handicapped populations. Overall, it can be concluded that operant procedures offer a realistic and practical alternative for improving a variety of reading skills for disabled learners, particularly if motivational factors are either the central cause or a primary contributor to poor school performance.

Summary and Statement of the Problem

The studies reviewed in this chapter have considered a wide range of possibilities for improving the reading comprehension of both average and below average learners. For convenience the research was discussed under three broad categories including those studies which have manipulated variables associated with reading materials, reader strategies, and the consequences of performance. In keeping with the overall purpose of the present research, the review of literature was limited primarily to those efforts which have focused on the learning of prose materials by school age children.

It seems that the question of how best to teach comprehension depends on characteristics of the total learning

situation including the nature of the task, the type of reader involved and other aspects of the total instructional setting. In this respect the remedial efforts which hold the most promise are those which have considered matching instructional strategies with individual differences in aptitudes and learning styles. The fact that many readers in higher grade levels are unable to comprehend material which they can adequately decode, provides the most direct evidence of the need for improving the verbal "processing" strategies of more mature learners.

There are data to support the existence of a variety of poor reader types who can be discriminated from one another both functionally and diagnostically (Cromer, 1970; Levin, 1973). Certainly comprehension problems are not always the end result of a common underlying disability, but more likely such difficulties are the product of a variety of etiologic factors. Consequently remedial treatment of comprehension difficulties depends to a certain extent on the prerequisite skills of the poor reader. From this perspective, the first priority of the remedial teacher is to identify various reader "deficiencies" or "interferences" which may be contributing to and/or causing comprehension problems.

In terms of the current literature, a useful paradigm for explaining reading difficulties is that which has been proposed by Wiener and Cromer (1967). This

framework provides a comprehensive model for viewing reading disorders which has both remedial and heuristic value. Thus far, followup research of this model has centered entirely on two types of poor readers, i.e., the "difference" and "deficit." As earlier noted, both of these types of poor readers are assumed to have adequate intelligence but demonstrate marked difficulties in comprehension presumably because of characteristically different problems in inputing what is read.

In terms of remediation, it is known that "difference" poor readers can adequately decode words but are unable to comprehend what is read because they organize their reading material in a non-meaningful, word by word fashion. However, these readers can significantly improve their comprehension in the direction of good readers when provided with a strategy such as "imagery" (Levin, 1973) or when the materials are preorganized (Cromer, 1970). Similarly, poor readers tend to comprehend as well as good readers when passages are presented in an alternative mode such as listening (Oakan, Wiener, and Cromer, 1971). However, to this point little is known regarding the nature of so-called "deficit" poor readers, except that they presumably lack vocabulary and/or word identification skills. The present study proposes a more complete analysis of such readers.

In particular, the primary focus of this investigation is to determine whether it is possible to increase the

comprehension skills of deficit poor readers without actually teaching them decoding skills. To do this, deficit and average readers will be compared under three instructional conditions and two input modalities (see design layout in Appendix A, Table 8). The treatments include imagery, incentive, and control under both reading and listening input modalities. The imagery condition has been previously established as a worthwhile treatment, at least for the "difference" type of poor reader. However, the incentive condition is added to determine what effect, if any, motivation has on performance. As suggested earlier, it could be argued that the positive effects achieved in the past have been due entirely to motivational factors. This condition, then, should test whether motivation is a significant factor in getting poor readers to perform more like good ones. While incentives have been employed effectively with a variety of disabled and normal learners, their value has not been extensively explored in the area of reading comprehension, nor have they been consistently employed with disabled readers, such as those of the "deficit" variety.

The above treatments will be presented via the modalities of "listening" or "reading" which are already known to interact with reader types (Bakan et al., 1971; Blanton, 1971; Lilly and Kellener, 1973). Although there is evidence which suggests that some poor readers can demonstrate a

general disability in language comprehension (Weinstein and Rabinovitch, 1971), it is likely that deficit poor readers can profit as much or more than average readers under a listening condition. Similarly, the combined treatments of "listening with imagery" should also reduce performance differences between the two reader types. Since it is assumed that deficit readers have difficulties primarily in decoding and vocabulary skills, it is hypothesized that a listening condition should reduce problems associated with these skill deficits and therefore increase the likelihood that they will benefit from imagery instructions.

In sum, then, the present study consists of a partial replication of the Levin (1973) study (incorporating an imagery condition) and a further refinement of the Oakan et al. (1971) reading-listening study (incorporating only poor readers of the deficit variety).

Hypotheses to be Tested

Although a variety of research questions can be generated from the present proposal, the following hypotheses appear most appropriate in terms of the rationale of the study as well as the findings of previous investigators. In addition, since the present emphasis is on treatments which facilitate comprehension for the deficit poor reader, the major hypotheses reflect directly on this problem.

Major Hypotheses

1. In accordance with Levin's (1973) results, reading with imagery should be no more effective than reading alone for deficit poor readers. However, for the average readers the effects of this treatment are expected to improve performance.
2. While listening is expected to be superior to reading overall, this should be especially so for the poor readers (Oakan et al., 1971). Deficit poor readers are expected to profit relatively more than the average readers, since listening should eliminate the deficit poor reader's decoding problems in comparison to the nondifficulty experienced by average readers. These hypotheses will be tested in terms of comparing the listening condition with reading for both types of readers. The overall improvement in performance (from reading to listening) for the deficit reader will then be compared with that of the average to determine whether a modality x reader type interaction effect exists.
3. The addition of an imagery strategy to the listening modality should further improve the comprehension of both types of readers by providing them with an effective organizational strategy--much in the same way it did for the difference poor readers in the reading with imagery condition of the Levin (1973) study and for the average readers in the listening with imagery condition

of the Levin and Divine-Hawkins (1974) study.

4. Whether or not the addition of an incentive results in increased reading or listening comprehension for the deficit and average readers is also of interest. In particular, the experimenter hoped to determine if it was possible to get improved performance via simply increasing the motivation of the readers.

CHAPTER II

METHOD

Subjects

Ninety-six subjects were selected from a Madison middle school which serves primarily a lower middle class population. The subjects were all sixth graders of approximately the same age and intelligence.

Reading Classifications

Reading classifications were based on the Wiener and Cromer model and included only "deficit" and "average" readers as specified in the "statement of the problem." Initially, all subjects were selected according to scores obtained on the "comprehension" subtest of the Sequential Tests of Educational Progress (STEP), administered in October, 1972.

"Average" readers were considered to be those subjects who fell within the 33rd percentile to 60th percentile range. (The total sample of average readers was comprised of 48 subjects, with the majority (88%) falling within the 40-60 percentile range.) Although this cutoff point is somewhat arbitrary, it is, according to the STEP norms,

representative of the low to high "average" readers in comprehension, i.e., 50th percentile = average. However, to assure the validity of these classifications, the author obtained a recommendation from each of the subject's teachers to determine experimenter-teacher agreement on the subject ratings. A summary of the STEP test (comprehension) information for the average readers is presented in Table 1.

Since the experimenter was interested in poor readers who demonstrated marked problems in comprehension as a result of decoding and/or vocabulary deficiencies, subjects were screened on the basis of three standardized tests. Poor readers were considered to be those subjects who scored in the 25th percentile or lower on the "comprehension" subtest of the STEP. To insure that these subjects also had corresponding difficulties in vocabulary and decoding skills, they were additionally tested on the vocabulary subtest of the Iowa Test of Basic Skills (ITBS, 1971 revision), administered by the present examiner in March of 1974. All subjects scoring at least a year below grade level on the Iowa were then given the reading (decoding) section of the Wide Range Achievement Test (WRAT), which was individually administered. This test was administered to obtain a grade level rating on decoding and word recognition for subjects who had previously demonstrated poor comprehension and vocabulary skills.

The final selection of deficit poor readers was based

TABLE 1

STEP MEAN PERCENTILE RATINGS AND STANDARD DEVIATIONS FOR THE AVERAGE READERS IN EACH CONDITION

		Condition		
		Control	Imagery	Incentive
STEP Percentile (Comprehension Subtest)	$\bar{X}$	47.37	45.93	45.87
	SD	6.01	8.91	7.13

on the difference between the reading score obtained on the WRAT and the subject's actual grade placement at the time of testing. WRAT (decoding) scores were expressed as grade equivalents which were compared to the child's grade expectancy at time of testing, e.g., 6.7. The number in front of the decimal point indicates the grade the child was in at time of testing, while the number following the decimal indicates the elapsed part of the school year. Thus 6.7 indicates that the child was in the sixth grade and that the test had been given between March and April of 1974. The main criterion was a grade level deficit of at least one year below level in decoding (WRAT = 5.7 or less). Additionally, the experimenter looked for consistency among scores obtained in comprehension (STEP), vocabulary (ITBS), and decoding (WRAT). In terms of task requirements, the comprehension section of the STEP demanded that each subject read a set of paragraphs and answer a series of multiple choice questions relating to the facts presented. The Iowa Test consisted of a group of vocabulary words and subjects were expected to select one of four answers which most nearly reflected the same meaning as the word to be defined. On the WRAT, words graded in difficulty were presented and the subject simply read the words, pronouncing each one so the examiner could hear them. Using these procedures the present experimenter felt reasonably assured that the subjects who were consistently at least one year below grade

level, on both vocabulary and decoding subtests, met the primary criterion of a "deficit" poor reader as defined by Wiener and Cromer (i.e., "subjects with marked comprehension problems and significant deficits in vocabulary and/or decoding skills").

In nearly all cases, subjects were consistently low on all three subtest measures and only occasionally was there a discrepancy of any magnitude. However, subjects whose scores were notably inconsistent or those who were known to demonstrate organic and/or emotional disturbances were excluded (i.e., subjects in special education classes who were labelled "emotionally disturbed," etc.). Again, to assure the validity of the deficit classifications, additional information in the form of teacher "agreement" as to the rating was obtained for each subject. In each case the subjects selected as "deficit" poor readers, on the basis of tests, were also similarly recommended by their teachers. Based on the WRAT (decoding) results a total of 73 percent of the deficit readers were more than one and one-half grades below level and 54 percent were more than two grades below level. A summary of the STEP (comprehension), WRAT (decoding) and the ITBS (vocabulary) information for deficit poor readers is presented in Table 2.

Based on the "average" and "deficit" classifications the subjects were then randomly assigned in equal numbers to the treatment groups.

TABLE 2

STEP, WRAT AND ITBS MEAN SCORES AND STANDARD DEVIATIONS FOR THE DEFICIT READERS

Screening Tests		Conditions		
		Control	Imagery	Incentive
STEP: Comprehension (Percentile)	$\bar{X}$	7.68	9.37	6.18
	SD	4.70	6.00	3.60
WRAT: Decoding (Grade Equivalent)	$\bar{X}$	4.32	4.91	4.28
	SD	1.14	.53	.75
ITBS: Vocabulary (Grade Equivalent)	$\bar{X}$	4.82	4.43	4.18
	SD	1.45	1.00	.87

Materials

The experimenter constructed two 14-sentence stories of approximately the same level of difficulty and equated with one another along several variables discussed in detail below. In developing the stories the author reviewed a number of reading materials appropriate for grade levels five, six, and seven. Similarly, a number of standardized tests with comprehension measures were surveyed to determine the characteristics of vocabulary words, syntax and concepts presented. However, the use of such tests in the present experiment was ruled out primarily because these materials were, generally, not of an imaginal nature and some called upon prior learning or otherwise did not comply with certain specifications as required by the nature of the experimental task. The reading passages were then constructed primarily from a list of sixth grade reading words and readjusted according to "trial and error" data collected through piloting exercises.

First, a "word bank" of potential target words was developed to use in the construction of the experimental materials. Similarly, ideas for the story format and types of comprehension questions were also noted. The list of potential words was then piloted on ten "poor" readers (i.e., those subjects with decoding problems) and ten "average" readers who were similar to the average and poor readers selected for the experimental populations. Based on these

pilot results a group of target words was selected in terms of difficulty as regards decoding, i.e., the poor readers were unable to decode them while the average readers generally had little difficulty in pronouncing them. These words were then used to compose approximately five stories with different themes but similar in word difficulty, vocabulary, grammatical makeup, length, etc. Of the five stories, two were selected to pilot under the "reading condition" alone, i.e., each subject was asked to read the stories and then answer questions about them. The stories and related questions were presented individually and in counterbalanced order. After each pilot of the experimental materials adjustments were made regarding ambiguities in questions and answers, facts presented, and overall level of difficulty.

Pilot data on the final revision of both stories suggested that they were generally equated on several variables determined to be critical for this type of task. That is, although the stories had different themes, each was more or less of a descriptive nature and similar in sentence length, overall vocabulary difficulty and total reading time. In addition, each sentence was similar in grammatical composition and presented a simple statement of fact. As well, subject ratings for story "preference" did not significantly favor one story over the other. The only other criterion for these stories was that the situation being depicted in each

sentence had to be imaginal, i.e., it could potentially evoke a visual picture in the mind of the reader.

Two sets of short answer questions were also developed which corresponded with the stories and reflected the main facts projected by each sentence. For some questions a variety of answers were accepted, the primary criterion being that they reflected an understanding of the facts presented. Each response was recorded on the appropriate answer sheet so that ambiguous or unique answers could be re-scored at a later time. The "comprehension" questions were designed primarily to tap into information gained from reading the stories and thus, were constructed so that they minimized the possibility of "guessing" or "conjecturing" an answer.

In terms of presentation, the stories were printed and tape recorded such that both stories could be represented via both listening and reading modes of presentation. The printed versions were typed in primary type onto 5 x 8 inch index cards, with one sentence per card, and assembled in two separate booklets. As well, each story was recorded onto two separate cassettes to be used under the listening condition. In addition, under the imagery condition only, a picture (spider crawling on a shirt) was used as an example to assist the subjects in developing visual images of the contents of the materials read or listened to.

For subjects under the incentive condition, the

experimenter provided a large bank of pennies from which the subjects could earn varying amounts of money depending on the number of correct responses they made.

Procedure

The experimental design consisted of two reader classifications, three treatments and two modalities, the latter factor administered within subjects. A total of 96 subjects were used in the experiment, 48 deficit and 48 average readers. Subjects were randomly assigned to treatment conditions with consideration being given to the order in which the stories were presented (2 stories x 2 modalities).

Subjects were tested individually in a small room. Since the design is one of "repeated measures," each subject received two passages, one under each modality. Subjects assigned to a specific treatment group remained in that group under both modalities (e.g., subjects assigned to the control group under the reading modality were also assigned to the control group under the listening modality). The overall design layout is presented in Appendix A (see p. 135). A counterbalanced order was used to control for possible effects due to differences in the stories. Prior to receiving the stories, subjects were instructed according to the experimental conditions cited earlier, i.e., control, imagery, or incentive.

In the control conditions the subjects were instructed either to read or to listen to the passages and then answer

comprehension questions asked by the examiner. When reading, subjects were simply presented with a booklet containing the story and permitted to turn the pages at their own rate. When listening, subjects were presented a taped version of the passage. A recorder was placed in front of the subject and turned on when the experimenter signalled "ready." Also, subjects were instructed not to ask questions or interrupt the recording while it was playing.

Subjects in the imagery condition received the same treatments as above, except that they were given additional instructions to visually image what they were reading or listening to. That is, the subject was asked to covertly translate each sentence into a mental image or pictorial representation of its contents.

In the incentive condition subjects were given the standard instructions for listening and reading but in addition they were told it was possible to earn one penny for each correct answer and more than 25 cents if they performed well. The choice of money as an appropriate incentive was determined primarily via a "reinforcement" survey conducted with students considered very poor in academics (Title I) but who were not part of the experimental sample. In this survey 20 subjects were presented with a hierarchy of choices regarding incentives they would prefer to earn (e.g., money, small candies, free time, playing a game, small prizes). The results of the survey indicated that about 75 percent

of the students very poor in academics clearly prefer to earn money over the other choices. On the basis of these results, money was chosen as the incentive for all subjects in the incentive condition (poor and average; listening and reading).

However, as regards the incentive condition, some precautions were taken to minimize the possible contamination of subjects who were not in the incentive condition but expected to receive incentives because of information passed along by other subjects. Thus, at the outset of each treatment, subjects were asked if they had any knowledge of what the "survey" was about. If the subject responded "yes," then the experimenter probed further to determine if the subject anticipated an incentive or knew anything about the stories, questions, or answers. Information relating to the subject's awareness of the experiment was recorded on the cover of his test protocol and in this way possible effects due to subject contamination were carefully tabulated.

In all treatment groups an example was used to help facilitate understanding of the task. However, in the imagery condition a picture (spider climbing a shirt) accompanied the example as one plausible image for the example sentence.

In addition each subject, regardless of treatment condition, was given 10 cents at the beginning of the experiment with no contingency on keeping the money other than

participation in the study. As well, all subjects were told that everyone in the survey would receive more or less the same amount of money. In this way all subjects were paid some money for their involvement. Subjects were also asked to keep their participation and understanding of the experiment "confidential" until all other subjects had completed the tasks. A date was given when confidentiality could be relaxed (i.e., at the conclusion of data collection). These procedures seemed the best solution to minimize the possible contamination of subjects in terms of knowledge of the experiment and anticipation of incentives.

Both stories and corresponding sets of questions and a complete set of instructions for all conditions are presented in Appendix B.

CHAPTER III

RESULTS

Performance for the deficit and average readers was defined in terms of the number of correct responses, out of 14, given following a single presentation of the passages. As described earlier, possible "contamination effects" were monitored carefully via a series of questions relating to subject "expectations" and prior knowledge of the experiment. It was noted that in each opening interview all subjects responded in the negative regarding knowledge of the experiment and there was no evidence of subject contamination (as discussed in the procedure section).

Scoring of test protocols was based on two systems, i.e., "rigid" and "flexible." Generally, correct responses for each question were carefully defined in advance and there was little variability in the criteria for scoring of answers. However, for the rigid system, responses were scored as either correct or incorrect with little or no consideration given to errors due to slight variations in the facts presented or those due to problems in "sequencing." Since some sentences pertaining to a single referent were

grouped together, it was possible to intermix referents such that the wrong attributes would be associated with them, e.g., in story #1, mixing up the second and first vehicles or in story #2, mixing up the two kinds of monkeys. In this respect, the characteristics of the referents were understood but they were not associated in correct sequence. However, the flexible system was more liberal as regards answers which were correct but out of sequence (i.e., sequential errors") and minor variations in the text. Each protocol was scored separately by two different scorers and then compared for differences in total scores and/or scores for individual responses. Any discrepancies between scorers on individual items were noted and reconciled until there was 100 percent agreement in the final scores given to each subject by both scorers. It is noteworthy that, overall, the two scorers had relatively few disagreements to start with. As well, there were no major differences in the two scoring systems (rigid and flexible) as noted by their correlation within each set of conditions. That is, within the reading treatments the two systems were correlated .85 and within the listening treatments they were correlated .95. However, the data on which the analyses were performed is based exclusively on the "rigid" scores of each group primarily because these tended to be the most consistent at the outset and reflected answers which were the most explicit in terms of the facts presented.

Initially, the experimental design consisted of a two (reading classifications) by three (treatments) by two (modalities) split plot factorial design. The experimenter proposed to carry out "nested" analyses using the full design and the combined scores of both the average and deficit poor readers. However, because of a chance problem in the assignment of subjects to treatment conditions the design and analyses had to be modified. That is, deficit poor readers assigned to the treatment groups turned out to be different in decoding skills at the outset of the experiment even though proper randomization was employed. Thus, since amount of comprehension is assumed to be directly related to decoding skills, performance on the comprehension task could be partially attributed to differences in the experimental groups at the outset and not necessarily to the treatments administered. Therefore, because of these differences, the overall design was adjusted to remove this source of bias from the experiment.

The mean scores and standard deviations for the STEP (comprehension), WRAT (decoding), and the ITBS (vocabulary) tests are listed in Table 2 (page 84, Method section) for deficit readers in each treatment condition. A "studentized range test" of the three STEP means revealed (C.V.=3.43, $q=2.61$, $df=45$, $p > .05$) that the comprehension scores of these subjects were equated at the outset of the experiment. However, a similar range test done on the three WRAT means

revealed (C.V.=3.43, q=3.43, df=45, $p < .05$) that these means were not equated at the outset. Subsequent pairwise comparisons (Tukey t) indicated that the visual imagery group had significantly higher decoding skills than the incentive group. Consequently, the average and deficit readers were not included in the same design but rather each was analyzed separately using an analysis of covariance for the deficit and analysis of variance for the average readers. However, except for separate consideration of the hypotheses for the deficit and average readers the planned comparisons remained the same.

Deficit Readers

Because of the differences among the treatment groups initially on the WRAT, the mean performance on the comprehension task was "adjusted" for each treatment group. Table 3 presents the adjusted means and standard deviations for the deficit readers under all treatment conditions and modes of presentation. These adjusted means were then used to test the hypotheses for the deficit group via planned comparison techniques. Specifically, as noted earlier (hypotheses to be tested), two treatment contrasts were planned within each modality (i.e., reading and listening) and one between modalities. In addition, both types of readers were compared for overall improvement in comprehension in listening as opposed to reading to determine possible interaction effects of reader type with modality. Each contrast was

TABLE 3

ADJUSTED MEANS AND STANDARD DEVIATIONS FOR COMPREHENSION SCORES OF DEFICIT READERS

Treatment		Modality	
		Reading	Listening
Control	$\bar{X}$	6.03	10.25
	SD	2.61	2.81
Imagery	$\bar{X}$	6.87	10.11
	SD	3.24	2.96
Incentive	$\bar{X}$	6.90	9.56
	SD	2.80	2.82

directional with the error rate per family being set equal to .05. Since two tests were performed within the reading modality and two within the listening, a type I error probability of .025, one tailed, was adopted for each. The error rate for the comparison between the reading and listening groups was equal to .05. Each treatment contrast was based on 35 df (i.e., the covariate, the order, the condition, and condition by order effects were all removed), whereas the modality contrast was based on 36 df (all the above except the covariate were removed). The interaction of reader type with modality was tested with a type I error probability of .05, one tailed, with 90 df.

Within the reading modality, reading with imagery and reading with incentives resulted in comprehension scores which were not significantly higher than those obtained by reading alone (i.e., $t=.8701$, $p > .025$ and $t=.9567$, $p > .025$, respectively). Similarly, under the listening condition, listening with imagery and listening with incentives did not facilitate comprehension significantly more than listening alone ($t=-.1377$, $p > .025$ and $t=-.7059$, $p > .025$, respectively). However, when performance under reading was compared with that of listening, a significant difference was noted ($t=-2.6476$, $p < .05$) in favor of the listening condition.

These results suggest that, for very poor readers, treatment strategies such as imagery and incentives have

little facilitating effect on the comprehension of materials either read or listened to.

For the sake of completeness an overall analysis of covariance was performed on the data using the WRAT scores as the covariate. Both reading and listening analyses are grouped together and presented in Table 9 in Appendix C.

Average Readers

For the average readers, the only screening measure employed was the comprehension section of the STEP test (means and standard deviations for each treatment group are presented in Table 1, page 81 of Methods section). As with the deficit readers, a studentized range test was performed on the three STEP means for the average readers to determine if there were chance differences in the comprehension skills of the three treatment groups. The results (C.V.=3.43, q= .8108, df=45, $p > .05$) revealed that there were no differences in the comprehension scores of these subjects and thus the three treatment groups were assumed to be equal in comprehension ability at the outset of the experiment.

Table 4 presents the means and standard deviations for the average readers under each experimental condition. The hypotheses tested and the planned comparison procedures employed are exactly the same as those for the deficit readers. In general, however, none of the experimental conditions resulted in significantly higher scores than the others and scores within and between reading and listening

TABLE 4

MEANS AND STANDARD DEVIATIONS FOR COMPREHENSION SCORES OF AVERAGE READERS

Treatments		Modality	
		Reading	Listening
Control	$\bar{X}$	9.94	10.25
	SD	2.32	2.37
Imagery	$\bar{X}$	10.87	11.06
	SD	2.96	2.11
Incentive	$\bar{X}$	9.62	10.94
	SD	3.22	2.35

conditions were relatively consistent. That is, within the reading condition, reading with imagery and reading with incentives were not significantly higher than reading alone ($t=.9412$, $p > .025$ and $t=-.3137$, $p > .025$, respectively). Similarly, listening with imagery and listening with incentives did not significantly improve comprehension over listening alone (i.e., $p > .025$ that $t=1.033$ and $t=.8744$, respectively).

A comparison of listening with reading alone also resulted in nonsignificant differences in comprehension (i.e., $p > .05$ for $t=-1.6137$). Contrary to the findings for the deficit readers, scores for the average readers indicate that comprehension was not improved when they changed modalities from reading to listening. Thus, it seems that the average readers performed equally well no matter what experimental condition they were in and their comprehension skills did not seem to be significantly affected by the modality and strategy manipulations employed in this experiment.

For both the listening and reading modalities total scores ranged from 4 to 14 correct. However, only 10 percent of the subjects in the reading modality scored 100 percent correct (i.e., 14 out of 14) and 12 percent under listening scored 100 percent correct. Therefore on the basis of the distribution of scores it seems feasible to discount "ceiling effects" as an explanation of the

consistent performance of this group of readers. That is, there is no evidence to suggest that performance across conditions was simply reflective of a task which was too easy for the average readers. Again, an overall analysis of variance is presented in Appendix C under Table 10.

Reader Type x Modality Interaction

Table 5 indicates that when improvement across modalities is compared for the average and deficit readers, there is a significantly larger modality effect for deficit readers. That is, there is a modality by reader type interaction, such that the deficit readers improve more when they go to the listening modality as compared with the average readers (C.V.=1.664, t=2.556, df=90, $p < .05$). Thus the listening modality made a much larger difference for the deficit readers than it did for the average.

Post Hoc Data Probing

In addition to the main contrasts discussed above, the author also did some post hoc data probing to investigate any effects due to treatments which were not planned for.

Rating Data

At the close of each treatment session the experimenter asked all subjects, regardless of treatment condition, two additional questions relating to the amount of "imagery" that occurred and the subject's level of preference for each story. The questions were as follows: "How much did you

TABLE 5

MEAN COMPREHENSION SCORES AS A FUNCTION OF READER TYPE AND MODALITY INTERACTION

	Reading	Listening
Deficit	6.60	9.97
Average	10.14	10.75

like the race car (monkey) story? Did you like it a lot, a little bit, or not very much?" "While the race car (monkey) story was going on, did you get any pictures in your mind of what was happening? Did you get a lot, a little bit, or none at all?" The subject's responses were then numerically rated as 1 for a response of "not very much" or "none at all," 2 for "a little bit," and 3 for "a lot." These scores were then tabulated for each subject and means and standard deviations were calculated for each treatment condition.

In terms of the rating data for the deficit and average readers, it was expected that, for both groups, subjects would report more imagery when told to image as opposed to the other conditions. Ratings as to the amount of imagery employed were considered relevant in terms of the Anderson and Kulhavy (1972) findings, which suggested that subjects given imagery instructions might not show superior comprehension since groups not given such instructions may report using imagery extensively. Thus, since the tendency to employ imagery is inadequately controlled and essentially unobservable, a straight-forward "reporting" by the subjects was expected to provide some insight into the extent to which this strategy was used.

Deficit Readers--As with the comprehension data, the "rating" means for the deficit readers were adjusted to account for chance effects due to WRAT score differences. Table 6 presents the adjusted means

TABLE 6

ADJUSTED MEANS FOR THE "LIKE" AND "IMAGERY" RATINGS OF THE DEFICIT READERS

	Treatments					
	Reading			Listening		
Ratings	Control	Imagery	Incentive	Control	Imagery	Incentive
Like	2.21	1.89	2.28	2.28	2.49	2.35
Imagery	2.19	1.91	2.27	2.37	2.63	2.19

for "like" and "imagery" ratings for the deficit readers. As well, Table 11 in Appendix C provides a breakdown of the analysis of covariance for the rating data.

The results indicate that under the reading modality neither "like" ($F=1.018$, $df=2/35$, $p>.05$) nor "imagery" ratings ($F=.896$, $df=2/35$, $p>.05$) were significantly different across treatment conditions. The same findings are true of "like" ($F=.363$, $df=2/35$, $p>.05$) and "imagery" ($F=1.312$, $2/35$, $p>.05$) ratings across treatments within the listening modality. Therefore, in spite of the experimental instructions within the listening or reading modalities, subjects reported about the same preference for the stories and the same amount of imagery. However, although it was not statistically tested here, the tendency was for subjects to report more visual images under the listening modality ($\bar{X}=2.39$) as compared with the reading ($\bar{X}=2.12$). This latter finding supports that of Levin and Divine-Hawkins (1974) where it was noted that visual imagery may be elicited more readily in listening tasks than in reading tasks.

In order to determine the measure of agreement or association between "like" and "imagery" ratings, across all deficit subjects, a Goodman-Kruskal Gamma test was performed for both the reading and the listening modalities. For the reading modality, the value of gamma was relatively high ($\gamma=.51$) indicating that the probability of the two ratings (like and imagery) being the same is 51 percent more than

the probability that they would be different. However, for the listening modality a much lower degree of association (γ =-.004) was obtained. In this case, the probability that the ratings would be different is .4 percent more than the probability of them being the same. Thus the ratings tend to agree more under the reading as compared with the listening modality.

Average Readers--The "imagery" and "like" rating means for the average readers are presented in Table 7. The analysis of variance for these data are included in Appendix C, Table 12. Similar to the deficit readers, the results indicate no significant differences across treatments within the reading modality for "like" ($F=.851$, $df=2/36$, $p > .05$) or "imagery" ratings ($F=1.744$, $df=2/36$, $p > .05$). Again, within the listening modality, there were no significant differences across conditions for "like" ($F=.429$, $df=2/36$, $p > .05$) or "imagery" ($F=.210$, $df=2/36$, $p > .05$) ratings.

The Goodman-Kruskal Gamma test was again performed for reading and listening modalities to determine the strength of association between the two ratings for these readers. Under the reading modality the gamma value (γ =.18) was relatively low indicating that the probability of the two ratings being the same was only 18 percent more than the probability they would be different. Under the listening modality a relatively high gamma value was obtained (γ =.44), suggesting that the probability that the ratings would agree

TABLE 7

MEAN SCORES FOR THE "LIKE" AND "IMAGERY" RATINGS OF THE AVERAGE READERS

	Treatments					
	Reading			Listening		
Ratings	Control	Imagery	Incentive	Control	Imagery	Incentive
Like	2.19	2.37	2.50	2.25	2.19	2.37
Imagery	2.25	2.56	2.25	2.19	2.31	2.19

was 44 percent higher than the probability that they would disagree. Thus, the rating data for the average readers indicates a higher association between imagery and like under the listening modality than under the reading. Also, consistent with the findings for the deficit readers, subjects reported the same preference for stories and the same amount of imagery across treatments within the same modality in spite of different instructions.

Further Analysis of Deficit Performance

After the data were tabulated for all readers, the experimenter identified several words in one story which were considered difficult to decode and yet critical in answering the corresponding comprehension questions. In particular it was noted that seven sentences of the race car story contained words assumed to be difficult for the poor readers to decode and essential in understanding the facts presented. It was predicted that, because of the difficulty of these items, the deficit readers would not be able to answer questions about these sentences under a reading condition. Performance on these seven items was recorded separately for the deficit readers to determine the degree of validity of the deficit classifications and to see if the prediction of poor performance on these items would be substantiated.

Under the reading modality, performance on the relatively "non-difficult" items (N=7) was compared with

that of the "difficult" items (N=7). A "difference t test" was performed to determine if performance on the non-difficult items was significantly better than on the difficult ones. In partial agreement with the predictions, the deficit readers answered significantly more non-difficult questions correct than difficult ($t=2.144$, $df=21$, $p < .05$). However, it is noted, that, on the average, the deficit readers got about one-half of the difficult items correct ($\bar{X}=3.54$). This suggests that these deficit readers may not have been as severely handicapped in decoding as first anticipated.

CHAPTER IV

DISCUSSION

Imagery

Generally, imagery as a reading comprehension strategy has been found to be successful in improving the comprehension of both normal and difference poor readers (Levin, 1973; Levin et al., 1974; Anderson and Kulhavy, 1972). However, as an organizational strategy for the deficit readers, it was expected that this treatment would be differentially effective under reading and listening modalities.

Reading with Imagery

For the poor readers, it was predicted that reading with imagery would not improve comprehension over reading alone. Since these readers demonstrated marked problems in decoding, it was assumed that they would not be able to effectively image what they could not read. On the other hand, for the average readers it was expected that imagery instructions would improve the comprehension of written passages significantly more than reading alone. Although these predictions were based on the studies mentioned above, the present findings only partially agree with them.

The results of the present study are consistent with the predictions for the deficit readers but not for the average. That is, comprehension under reading alone did not differ significantly from that of reading with imagery for the poor readers. However, average readers were expected to benefit from a strategy such as imagery because it has been demonstrated to be facilitating for readers who can decode properly and who have sufficient vocabulary skills (Levin, 1973). While the average readers in the present study did improve slightly (9% more correct responses) when given instructions to image as compared with reading alone, the results were not statistically significant.

Listening with Imagery

In contrast to the above expectations for reading, under the listening modality, it was expected that imagery instructions would improve comprehension more than listening alone for the deficit readers. It was assumed that the listening modality would provide the deficit readers with an input system that would enable them to process the materials presented. As well, the addition of instructions to image was expected to provide them with an organizational strategy to facilitate recall of the facts and events presented. Consequently listening with imagery was predicted to result in higher scores than listening alone for these poor readers. Similarly, for the average readers, the addition

of an imagery strategy with listening was expected to increase comprehension as compared to listening without imagery.

Surprisingly, for the deficit readers, listening with imagery resulted in slightly lower comprehension scores than those obtained by listening alone, although the difference was very small. The average readers did improve slightly (8% more correct responses) when given instructions to image, as compared with listening alone, but the difference was not significant. Therefore, the imagery findings under listening were consistent with those under reading. In both modalities, instructing the deficit and average readers to visualize the thematic content of the passage did not improve their comprehension over that achieved by simply having them read or listen to the stories.

Imagery Instructions

The fact that the imagery strategy was not helpful for either the average or deficit readers, within appropriate treatment situations, suggests a few possible explanations.

Within the reading modality, it is likely that the deficit readers were simply unable to adequately employ imagery because of decoding problems. However, for both the average (under reading and listening) and the deficit (under listening) other explanations relating to pre-learning instructions and imagery production seem more feasible.

In spite of the experimental instructions within the listening or reading modalities, deficit and average subjects

reported about the same amount of imagery production. It may be that all subjects regardless of their instructional condition, generated images while reading or listening to the passages. This possibility is somewhat supported by Anderson and Kulhavy (1972) who discovered that high school students reported generating visual images, without being instructed to do so, and that these subjects recalled more about passages than students who did not.

A related explanation, also supported by Anderson and Kulhavy, is that the imagery subjects may not have been adequately induced to generate images by the simple preliminary instructions offered by the experimenter. It may be that, in order to adequately elicit imagery, subjects need more extensive training than that employed in the present experiment. In this respect, as noted by Levin et al. (1973), it is likely that various "learner types" differ with respect to their ability to effectively use an imagery strategy in a reading comprehension exercise. Thus, for "low visual imagers" preliminary instructions to employ visual imagery may be ineffective without some consideration of training exercises.

In summary, it seems likely that both the average (under listening and reading) and deficit readers (under listening) have the appropriate skills to image and could do so if adequately instructed and pretrained. The fact that visual imagery instructions were not more facilitating than other

treatments suggests that either imagery was not effectively induced via the present experimental procedures or that all subjects imaged similarly in spite of being assigned to other treatments. At present either interpretation is plausible and it is recommended that any replication of the present efforts should take into consideration more extensive pre-training exercises for inducing imagery, and, as well, should consider the modality preferences of the readers involved. Of particular relevance here is a discussion by Lesgold et al. (1974) in which the authors report a procedure which was effectively used in training third and fourth graders to overcome their initial inability to benefit from imagery instructions. Thus, it seems that pre-treatment exercises can make a difference.

Sample Size

One other interpretation is also possible in terms of "power" and sample size. For the average readers, it was noted that the results were in the right direction (i.e., improvement with imagery) but apparently were not large enough to be statistically significant. This could be the partial result of the relatively small number of subjects employed within the imagery condition (N=16). That is, the number of subjects may have been too small to provide adequate power to detect significant differences. Since the present findings with regard to the imagery treatment are inconsistent with previous data, further investigation

employing a larger sample size and more extensive imagery training is recommended to examine the reliability of these findings.

Incentives

An "incentive" condition was included for two reasons: 1) to determine whether part of the poor reading of "deficit" readers could be attributed to a lack of motivation; and 2) to determine whether some or all of the facilitation due to imagery instructions in the past could be attributed simply to increased motivation on the part of the subjects. In general, it was expected that the performance of the deficit readers would be influenced relatively more by the use of incentives than that of the average readers. For the deficit readers, the introduction of incentives was expected to minimize performance problems associated with various motivational factors. On the other hand, average readers were assumed to be more self-motivated and self-reinforced, and consequently performance was expected to be influenced much less by the introduction of external incentives.

Reading with Incentives

Although deficit readers are likely to display motivational problems when reading the marked decoding difficulties of these subjects were expected to inhibit any positive effects likely to be gained via an increase in motivation. However, the average readers were expected to show some improvement in reading with incentives as opposed to reading

alone.

The results suggested that, for both the deficit and average readers, the addition of incentives to a reading condition did not significantly improve comprehension over that achieved by simply reading alone. One possible explanation for these findings is that, for each of these groups, motivational problems were not primary factors which inhibited overall performance. For the deficit readers, skill deficits were probably the main problem, whereas for the average readers, motivation was likely not a problem at all. However, other explanations in terms of "novelty effects" and the actual "reinforcement value" of the incentives employed are also feasible.

Listening with Incentives

Under the listening modality deficit readers were expected to perform relatively better under listening with incentives as compared with listening alone. Since the decoding problems of these readers would be minimized in this modality, it was conjectured that listening to the materials would result in improved comprehension and that if motivation was a problem the added incentives would motivate the subjects to perform well on the post-test. Similarly, the average readers were also expected to improve in comprehension under listening with incentives as opposed to listening alone. Therefore, both groups of readers were predicted to show some improvement in performance when stories were read to them with clear

contingencies placed on comprehension of the materials.

Although the findings for the average readers were in the right direction, the results indicated that for both types of readers, listening with incentives did not facilitate comprehension significantly more than listening alone. Once again, it can be suggested that motivational factors may not have been a major contributing problem, but other explanations are also possible.

Choice of Incentives

One obvious explanation for the lack of significant effects of the incentive treatment is that the "money" incentive employed in this experiment was not powerful enough to influence the performance of either the poor or average readers. However, the choice of money as a viable incentive was based directly on the results of a reinforcement interview carried out with subjects similar to the deficit group. In addition, anecdotal evidence of subject reactions to the incentive instructions indicated consistent acceptance of the money incentive and general elation and excitement by the prospect of earning money for performance. Without exception, all deficit and average subjects reacted favorably to the incentive condition and it seems likely that both the type and amount of "pay off" were potentially motivating for the subjects.

Novelty Effects

Another interpretation for these results is that all subjects may have been equally motivated simply because of the novelty effects of the experimental situation. That is, for these subjects, the novelty of participating in the experimental task (regardless of treatment) may have been as potentially motivating as the introduction of money or other tangibles. This is particularly relevant for the imagery condition where it has been hypothesized previously that effects within an imagery treatment can sometimes be partially attributed to the increased motivation generated by this strategy (Paivio, 1971). Similarly, "listening," in and of itself, has been previously demonstrated to be an effective incentive for poor learners (Lipe and Jung, 1971). At the least, listening to the story probably minimized the deficit poor reader's anxiety regarding his inability to decode and consequent expectation of failure.

It could also be argued that the "effects" of the incentive could possibly have influenced performance differently on the first as compared with the second story. That is, due to the increased familiarity with the task it would be possible for subjects to be influenced either to improve or worsen in performance when moving from the first to the second story, particularly in terms of earning an incentive. However, comparing the mean scores of the first story with those of the second for both the average and deficit readers

(in the incentive condition) indicated they were very close. Therefore, it can be concluded that the effects of the incentive did not differ significantly across stories. It seems likely that providing feedback (i.e., pay off) at the completion of both tasks may have minimized the influence that the first task had upon the second.

It is also possible that paying the subjects at the outset of the experiment for their participation may have strongly influenced the subsequent level of involvement and overall performance of these subjects. In short, motivation could have been induced by a number of variables which are generally not involved in a more traditional learning situation. While the findings generally suggest that incentives did not improve comprehension relatively more than other treatments, it cannot be concluded they did not have an effect. In fact, for both average and poor readers all conditions may have been equally motivating.

Deficit Readers and Motivation

A final interpretation involves a general consideration of the motivation factor for the deficit type of poor reader. For these readers difficulties in attention, perseverence, and achievement motivation can all contribute to difficulties in reading performance. If decoding and comprehension skills are not in tact, then the act of reading may contain many aversive and negative components. Since good

reading achievement depends upon attentional and motivational components as well as good decoding skills, then some measures should be taken to insure that the reader is involved and attending to the reading task. Perhaps the best that can be said for the introduction of incentives for the reading condition is that it simply insured subject participation, perseverence, and involvement in the experimental task (i.e., it removed some interfering factors), but did not result in higher comprehension scores because these subjects simply lacked the basic skills necessary to improve performance.

However, under the listening modality the "skill deficit" factor was minimized and thus the deficit readers were not only better able to be "involved" in the task, but also had the skills to perform on the same level as the average readers. It seems likely that when comprehension of learning materials is separated from decoding and processing of printed words, then poor readers may be as motivated as average readers to perform well. While the introduction of tangible incentives did not result in significantly higher performance than that achieved in the other conditions, the "motivational effects" due to the novelty of the task and the experimental situation cannot be discounted. It may be that motivation was initially a problem for these readers, but that the nature of the experimental situation helped to overcome this factor across all treatments. In conclusion,

with the many variables operating in the present experiment it is not possible to specify what effects the incentives may have had in relation to those elicited by the nature of the experimental task itself.

Reading and Listening

A central purpose of the present research was to determine if very poor decoders could be provided with an alternative method for processing and comprehending written materials without actually teaching them decoding skills. It has been previously demonstrated that poor readers can comprehend as well as good readers when passages are presented in an alternative mode such as listening (Oakan et al., 1971). However, to this point, little has been done with very disabled readers (deficit) who demonstrate comprehension problems primarily as a result of decoding difficulties.

A comparison of comprehension under reading as opposed to listening modalities has offered the most direct evidence that very poor readers can easily comprehend relatively difficult materials if they do not have to perform the operations involved in decoding words. Consistent with expectations, listening provided a marked increase in comprehension over that of reading and this improvement across modalities, was much larger for the deficit as compared with the average readers.

It seems that the primary difficulty encountered by

very poor readers can be focused entirely on the process of reading (decoding) and thus other deficits in the "learning" or "memory" processes are not necessarily implicated. Therefore, a viable alternative, particularly for students who demonstrate marked skill deficits, in spite of many attempts at remediation, is to present learning materials in alternative modes. Rather than utilize primarily printed materials for teaching subject matter, an attempt should be made to provide a parallel curriculum developed primarily around auditory input systems (e.g., tapes, lectures, movies). Considering the importance of sensory modalities in children's learning, curricula should be potentially flexible enough so that it can easily be modified to suit individual differences in learning styles (Bissell et al., 1971).

For the average readers, it was expected that they would comprehend about the same under listening as they do under reading. These readers were assumed to be generally proficient in both modalities and thus neither was expected to offer any learning advantage over the other. Consistent with the predictions, these readers comprehended equally well under both conditions. However, it would have been interesting, if these readers had been subdivided into visual and auditory preference groups, to see if modality matching (preference with mode of presentation) might have resulted in even higher comprehension scores. This could

possibly have been accomplished via the use of standardized tests (Wepman, ITPA, etc.) which measure visual and auditory strengths or subjects might have been simply asked what they typically prefer to do, i.e., "read" or "listen."

Validity of Deficit Classifications

In terms of post hoc data probing, discriminating the performance of deficit readers on difficult (in terms of decoding) versus relatively easy comprehension items provided some insight into the validity of the deficit classifications. Clearly, as indicated by a "difference t test," the performance of the poor readers was much better on items where comprehension was not contingent on decoding difficult words as compared with those where it was. However, the deficit readers did get about one-half of the difficult items correct, which indicates they were decoding some words initially considered too difficult for them. This suggests that some of these readers may not have had as serious a deficit in decoding as first suspected.

This discrepancy could be partially explained in terms of the procedures used in classifying the poor readers. Although several instruments were used for this purpose, the reading section of the WRAT was accepted as the primary criterion for determining grade equivalents in decoding. However, according to a recent publication from the National Health Survey, on the reliability and validity of the WRAT (Department of Health, Education and Welfare, 1974, Series

11, Number 136, p. 3), "In estimating grade level placement, the WRAT was found to vary considerably, ranging from close agreement to wide disagreement with various criteria applied. Level II (12 years and older) tends to underestimate actual grade placement." Therefore, since about 27 percent of the readers were only 1-1½ grades below level on the decoding section of the WRAT, these subjects may have been closer to grade level in decoding than their scores suggested. Thus, any replication of the present study should attempt a more reliable diagnosis of the poor readers.

One final consideration in terms of the deficit performance is related to the possibility of information leakage from subject to subject over time. Although some precautions were taken to monitor such "contamination effects," these efforts (as discussed earlier) were based primarily on subject interviews. However, when the mean scores of the deficit readers were compared over time (sequentially separated into quarters) there was no apparent evidence of systematic change in performance from the beginning to the end of the study. Therefore, the relatively good performance of the deficit readers cannot be attributed to the contamination of subjects over time via information leakage. It is more likely that confidentiality among subjects was maintained and that the surprisingly good performance of these poor readers again casts some doubt upon the validity of the deficit classifications.

Limitations of Study

Overall, the results of the present study indicate that the primary difficulties faced by deficit poor readers, in comprehending printed materials, is their inability to decode words and that additional disabilities in memory or learning, or associating facts are not necessarily implicated. Such deficit readers appear motivated and capable of learning verbal materials, as well as average readers, when the information is presented in an appropriate modality.

While these conclusions seem valid according to the findings of this study, there are several limitations observed in regard to the present efforts. First, as mentioned above, some poor readers employed in this study may not have been reliably diagnosed. Therefore, in any replication of the present study, a more precise classification of readers, who are poor in decoding, should be attempted. In terms of treatment conditions more emphasis should be focused on pre-treatment training exercises in imagery production, particularly for the poor readers. It is not clear from the present results whether or not the subjects understood what was expected of them under this condition. Also, for the incentive condition, it was difficult to sort out effects which may have been due to the incentives (money) as compared with those due to other motivational factors associated with general participation in the experiment. Finally, the conclusions relating to the

treatment effects on comprehension are limited to the populations investigated and to the type of materials and tasks employed in this study, i.e., descriptive stories requiring short term memory of facts presented.

CHAPTER V

SUMMARY AND CONCLUSIONS

The primary focus of the present investigation was to examine the efficacy of various strategies in terms of improving the reading comprehension of deficit readers without actually teaching them decoding skills. To do this, deficit and average readers were compared for performance on a comprehension task under three instructional-treatment conditions and two input modalities. The treatments included imagery, incentive and control under both reading and listening modalities. These treatment conditions seemed the most interesting in terms of previous research data and were expected to provide a reasonable extension of what is already known regarding the Wiener and Cromer (1967) model. While the research questions were directed mainly at gaining insight into the comprehension skills of deficit poor readers, a similar set of research questions was evaluated in regard to average readers.

In agreement with Levin's (1973) results, it was expected that reading with imagery would be no more effective than reading alone for the deficit poor readers.

however, average readers were expected to improve slightly under reading with imagery as compared with reading alone (Levin and Divine-Hawkins, 1974; Levin et al., 1973). While listening was expected to be superior to reading in general, the most improvement was predicted for the poor readers (Oakan et al., 1971). The auditory presentation of the passages was expected to minimize the deficit reader's decoding problems and thus increase the likelihood that they would understand what was read to them. Similarly, the addition of an imagery strategy to the listening condition was predicted to improve the comprehension of deficit poor readers by providing them with an effective organizational strategy within a modality which would enable them to profit from it. The average readers were expected to improve their performance under both reading and listening with imagery as compared with reading or listening alone.

Finally, whether or not the addition of an incentive would result in increased reading and listening comprehension for the deficit and average readers was also of interest. However, it was expected that the comprehension problems of the deficit readers are not primarily motivational and that the incentive conditions would have little overall effect on the short term performance of these readers, particularly with the reading modality.

A total of 96 students (48 deficit and 48 average readers) of approximately the same age and intelligence were

selected from a lower socio-economic Madison Middle School. Reading classifications were based on the Wiener and Cromer model and were determined by scores obtained on the comprehension subtest of the Sequential Tests of Educational Progress, the vocabulary subtest of the Iowa Test of Basic Skills and the reading section (decoding) of the Wide Range Achievement Test. Subjects were tested individually in a small room and, since the design was one of "repeated measures," each subject received two passages, one under each modality. Prior to receiving the stories (presented in counterbalanced order) subjects were instructed according to the experimental conditions cited earlier.

Because of an unexpected result of the assignment of subjects to treatment conditions, the design and analyses performed were slightly modified. That is, deficit poor readers assigned to the treatment groups were not equated on decoding skills at the outset of the experiment even though "randomization" was employed. Since amount of comprehension is assumed to be directly related to decoding skills, scores on the comprehension task had to be adjusted for these readers. Consequently, the average and deficit readers were not included in the same design and thus were analyzed separately, using analysis of covariance for the deficit (WRAT scores as the covariate) and analysis of variance for the average readers. All planned comparisons remained the same.

The findings indicated that performance expectations for the deficit readers were generally consistent with experimental predictions for each treatment group except that of listening with imagery. Within the reading condition, reading with imagery and reading with incentives resulted in comprehension scores which were not significantly higher than those obtained by reading alone. However, contrary to expectations under the listening condition, listening with imagery did not facilitate comprehension significantly more than listening alone. Finally, the most impressive finding to emerge from this study was obtained when comprehension scores of deficit readers under reading alone were compared with those of listening. Large gains were made in comprehension when these readers moved from a reading to a listening modality. Also, there was a reader-modality interaction effect such that the deficit readers improved significantly more than the average readers when changing from reading to listening. Thus, the poor readers were able to greatly improve in comprehension when the learning materials were presented in an appropriate modality.

Overall, the average readers performed equally well no matter what experimental condition they were in and their comprehension skills did not seem to be significantly affected by the modality and strategy manipulations employed in this experiment. Based on the distribution of scores, "ceiling effects" were discounted in explaining the

performance of the average readers and plausible explanations were offered to account for the results obtained for both the average and deficit readers.

Some additional data probing in regard to amount of imagery employed by each subject and preference for stories suggested some partial explanations of the results obtained. Overall, neither the deficit nor the average readers reported imagery more in one condition than in the other. Similarly, there were no significant differences in preferences for stories. Thus, in terms of subject reports, the use of imagery did not differ across treatment groups, in spite of experimental instructions. Therefore, it is possible that, within a reader group, all subjects employed the same amount of imagery. Implications for pre-training exercises in the use of imagery were discussed.

A final analysis of the performance of deficit readers was tabulated for certain comprehension questions where correct responses were contingent on proper decoding of target words. It was noted that the deficit readers were, on the average, able to get one-half of these difficult items correct. This suggested that some of the deficit readers may have been better in decoding then first suspected. Problems in terms of deficit reader classifications were noted as a partial explanation for this problem.

From these results it can be concluded that deficit poor readers can comprehend verbal materials significantly

better when they are presented in a manner which minimizes their problems in decoding or vocabulary skills. It seems that the primary difficulty encountered by these readers is focused on the process of decoding and therefore other difficulties in motivation, memory, or association of facts are not necessarily implied.

A reasonable alternative, particularly for students with severe skill deficits in spite of many attempts at remediation, is to present learning materials in an alternative mode. Rather than emphasizing primarily printed materials for teaching subject matter, alternative curriculums should be developed primarily focusing on auditory input systems. It is well established that students demonstrate a variety of learning styles and consequently learning materials should be potentially flexible enough to accommodate individual differences in these styles.

While the overall findings of this study suggest some remedial alternatives for populations seriously handicapped in reading skills, the conclusions and results should not be generalized beyond the populations investigated nor should they be applied to materials which differ remarkably from those employed in this study. In addition, as mentioned earlier, there are several limitations observed in regard to this study. In particular, problems were noted in the classification of deficit readers and in the implementation of both the imagery and incentive treatment conditions.

Therefore, interpretation of the findings is necessarily limited by these problems.

In terms of additional research, it is recommended that other materials be investigated to determine how comprehension is affected by certain stimulus related factors. Certainly, comprehension of verbal materials which are sequentially related as compared with unrelated and meaningful versus non-meaningful materials should be more fully investigated. Similarly tasks which require other types of comprehension (conceptual, inferential, etc.) perhaps calling upon long and short term memory skills, should be studied. Also, a variety of poor reader types should be employed including those of the difference and disruptive types to determine differential effects of treatments. It was further recommended that average readers be classified according to modality preferences and that intramodal matching could be attempted to create a more effective learning environment for readers considered at or above grade level.

In conclusion, before definitive statements can be made regarding the above relationships, data must be collected on more criterion-referenced academic materials. The effectiveness of various treatment strategies is contingent upon the characteristics of the populations studied, the types of stimulus materials employed, and the situation within which the learning materials are presented. Although some of the skills and mental processes involved in the

comprehension of verbal materials are being successfully investigated outside the classroom, a clearer distinction is necessary in terms of the specific abilities required for differing types of comprehension necessary within the context of actual classroom learning.

BIBLIOGRAPHY

Albright, B. F. Typical reading disabilities of college entrants. Unpublished master's thesis, University of Southern California, 1927.

Anderson, R. and Hidde, S. Imagery and sentence learning. Journal of Educational Psychology, 1971, 62, 526-530.

Anderson, R. and Kulhavy, R. Imagery and prose learning. Journal of Educational Psychology, 1972, 63, 242-243.

Auerbach, I. An analysis of reading comprehension tests. Final report. Unpublished doctoral dissertation, Howard University, 1971.

Ausubel, D. Educational Psychology: A Cognitive View. New York: Holt, Rinehart and Winston, 1968.

Bandura, A. Principles of Behavior Modification. New York: Holt, Rinehart and Winston, Inc., 1969.

Bissell, J.; White, S.; and Zivin, G. Sensory modalities in children's learning. In G. S. Lesser (Ed.), Psychology and Educational Practice. Illinois: Scott, Foresman, and Company, 1971, 130-155.

Blanton, B. Modalities and reading. The Reading Teacher, 1971 (Nov.), 210-212.

Blodgett, H. C. The effect of the introduction of reward upon the maze performance of rats. University of California Publication Psychology, 1929, 4, 113-134.

Bloomer, R. The effects of non-overt reinforced cloze procedure upon reading comprehension. National Reading Conference, 1966, 31-40.

Bobrow, S. and Bower, G. Comprehension and recall of sentences. Journal of Experimental Psychology, 1969, 80, 455-461.

Bormuth, J.; Manning, J.; Carr, J.; and Pearson, D. Children's comprehension of between and within sentence syntactic structures. Journal of Educational Psychology, 1970, 61 (5), 349-357.

Bower, G. Analysis of a mnemonic device. American Scientist, 1970, 58, 496-510.

Bower, G. H. Mental imagery and associative learning. In L. Gregg (Ed.), Cognition in Learning and Memory. New York: John Wiley and Sons, 1971.

Briggs, F. Grammatical sense as a factor in reading comprehension. The Psychology of Reading Behavior, National Reading Conference Inc., Milwaukee, Wisconsin, 1969, 145-149.

Bruininks, R. Relationship of auditory and visual perceptual strengths to methods of teaching word recognition among disadvantaged Negro boys. Dissertation Abstracts, 1969, 30A, 1010-A.

Bugelski, B. R. Words and things and images. American Psychologist, 1970, 25, 1002-1012.

Bursuk, L. Sensory mode of lesson presentation as a factor in the reading comprehension improvement of adolescent retarded readers. Educational Abstracts (1969).

Carmean, S. and Weir, M. Effects of verbalizations on discrimination learning and retention. Journal of Verbal Learning and Verbal Behavior, 1967, 6, 545-550.

Carroll, R. P. An Experimental Study of Comprehension in Reading. New York: Bureau of Publications, Teachers College, Columbia University, 1927.

Carver, R. P. A critical review of mathemagenic behaviors and the effect of questions upon the retention of prose materials. Journal of Reading Behavior, 1972, 4, 93-119.

Chapman, C. An Analysis of Three Theories of the Relationships Among Reading Comprehension Skills. Symposium on Psycholinguistics and Reading presented at the meeting of the International Reading Association, Kansas City, May, 1969.

Chomsky, N. Aspects of the Theory of Syntax. Cambridge, Mass.: M.I.T. Press, 1965.

Cleland, D. The Nature of Comprehension. Pittsburgh University, Pennsylvania School of Education, 1966 (Report on "Progress and Promise in Reading Instruction").

Cohen, D. The effect of literature on vocabulary and reading achievement. Elementary English, 1968, 45, 209-217.

Cohen, H. Model: Motivationally oriented designs for an ecology of learning. In H. L. Cohen, I. Goldiamond, J. Filipczak, and R. Pooley (Eds.), Training Professionals in Procedure for the Establishment of Educational Environment. Silver Springs, Md.: Educational Facility, 1968.

Cromer, W. The difference model: A new explanation for some reading difficulties. Journal of Educational Psychology, 1970, 64, 471-483.

Cromer, W. and Wiener, M. Idiosyncratic response patterns among good and poor readers. Journal of Consulting Psychology, 1966, 30, 1-10.

Cunningham, D. J. The effects of verbal, imagined, and rote instructional sets on the learning of concrete and abstract sentences. Paper presented at the annual meeting of the American Educational Research Association, Chicago, April 1972.

Davis, F. Fundamental factors of comprehension in reading. Psychometrika, 1944, 9, 185-197.

Davis, F. Psychometric research on comprehension in reading. Reading Research Quarterly, 1972, 7 (4), 628-678.

Deese, J. and Hulse, S. The Psychology of Learning. McGraw-Hill Book Company (Third Edition), 1967.

Denner, B. Representation and syntactic competence of problem readers. Child Development, 1970, 41, 881-887.

Duker, S. Listening and reading. Elementary School Journal, 1965, 321-329.

Esposito, M. Role of Immediate Recall in Selected Comprehension Tests at the Junior High School Level. Unpublished doctoral dissertation, Rutgers University, 1971.

Fagan, W. T. Transformation and comprehension. The Reading Teacher, 1971, 25, 169-175.

Farnham-Diggory, S. Symbol and synthesis in experimental reading. Child Development, 1967, 38, 223-231.

Freer, F. Visual and Auditory Perceptual Modality Differences as Related to Success in First Grade Reading Word Recognition. Unpublished dissertation, Rutgers University, 1971.

Frase, L. T. Influence of sentence order and amount of higher level text processing upon reproductive and productive memory. American Educational Research Journal, 1970, 7, 307-319.

Frase, L. T. Maintenance and control in the acquisition of knowledge from written materials. In R. O. Freedle and J. B. Carroll (Eds.), Language Comprehension and Acquisition of Knowledge. Washington: V. H. Winston and Sons, 1972, 337-357.

Frase, L. T. Paragraph organization of written materials: The influence of conceptual clustering upon the level and organization of recall. Journal of Educational Psychology, 1969, 60, 394-401.

Frase, L. T. Questions as aids to reading: Some research and theory. American Educational Research Journal, 1968, 5, 319-332.

Frase, L. T. and Washington, E. D. Children's ability to comprehend text. Paper presented at the annual meeting of the American Psychological Association, Miami, September, 1970.

George, J. Fixed and variable ratio reinforcement of reading performance. Nineteenth National Reading Conference, 1970, I, 146-151.

Goodman, K. S. A psycholinguistic view of reading comprehension. National Reading Conference, 1966, 15, 188-195.

Goodman, K. S. Reading: A psycholinguistic guessing game. Theoretical Models and Processes of Reading (Edited by H. Singer and R. B. Ruddell). Newark, Delaware: International Reading Association, 1970, 259-272.

Guthrie, J. Models of reading and reading disability. Journal of Educational Psychology, 1973, 65, 1, 9-18.

Harker, J. An evaluative summary of models of reading comprehension. Journal of Reading Behavior, 1973, 5, 26-34.

Harris, C. Measurement of comprehension in literature. The School Review, 1948, 56, 280-289, 332-342.

Harris, W. J. and Rohwer, W. D. Prose learning in children as a function of presentation mode, test condition, and population, Unpublished, 1974.

Hewett, F. Educational engineering with emotionally disturbed children. Exceptional Children, 1967, 33, 459-467.

Hewett, F. The emotionally disturbed child in the classroom: A developmental strategy for educating children with oral adaptive behavior. Mental Hygiene, 1968, 51, 75-83.

Miller, J. H. Learning from prose text: Effects of readability level, inserted question difficulty and individual differences. Journal of Educational Psychology, 1974, 66, 202-211.

Holmes, J. and Singer, H. Speed and Power of Reading in High School. Washington, D.C.: U.S. Government Printing Office, 1966 (Cooperative Research Monograph, No. 14).

Jenkinson, M. Information gaps in research in reading comprehension. National Reading Conference, 1970, 19, 179-192.

Kennedy, D. and Wiener, P. Visual and auditory training with the cloze procedure to improve reading and listening comprehension. Reading Research Quarterly, 1973, 8, 524-541.

Kennedy, W. and Willcutt, C. Praise and blame as incentives. Psychological Bulletin, 1964, 62, 323-332.

Laurita, R. Rehearsal: A technique for improving reading comprehension. Academic Therapy, 1972, 8, 103-11.

Lefevre, C. Linguistics and the Teaching of Reading. New York: McGraw-Hill Book Co., 1964.

Lesgold, A. M.; Curtis, M. E.; DeGood, H.; Golinkoff, R. M.; McCormick, C.; and Shimron, J. The role of mental imagery in text comprehension: Preliminary studies. Learning Research and Development Center, University of Pittsburgh, 1974.

Levin, J. R. Comprehending what we read: An outsider looks in. Journal of Reading Behavior, 1972, 4, 18-28.

Levin, J. R. Inducing comprehension in poor readers: A test of a recent model. Journal of Educational Psychology, 1973, 65, 19-24.

Levin, J. R.; Davidson, R. E.; Wolff, P.; and Citron, M. A comparison of induced imagery and sentence strategies in children's paired-associate learning. Journal of Educational Psychology, 1973, 64, 306-309.

Levin, J. R.; Ghatala, E. S.; Wilder, L.; and Inzer, E. Imagery and vocalization strategies in children's verbal discrimination learning. Journal of Educational Psychology, 1973, 64, 360-365.

Levin, J. R. and Divine-Hawkins, P. Visual imagery as a prose-learning process. Journal of Reading Behavior, 1974, 6, 23-30.

Levin, J. R.; Divine-Hawkins, P.; Kerst, S.; and Guttmann, J. Individual differences in learning from pictures and words: The development and application of an instrument. Journal of Educational Psychology, 1974, 66, 296-303.

Lilly, S. and Kelleher, J. Modality strengths and aptitude-treatment interaction. Journal of Special Education, 1973, 7, 5-13.

Lipe, D. and Jung, S. Manipulating incentives to enhance school learning. Review of Educational Research, 1971, 41, 249-280.

Lovaas, O. Learning theory approach to the treatment of childhood schizophrenia. Behavior Theory and Therapy, 1968.

Martin, R. Decoding and the quest of meaning. Journal of Reading, 1969, 1, 22-30.

Matz, R. and Ronwer, W. Visual elaboration of text. Paper presented at annual meeting of the American Educational Research Association, New York, 1971.

McConkie, G. and Rayner, K. Investigation of reading strategies: Manipulating strategies through payoff conditions. Journal of Reading Behavior, 1974, 6, 9-18.

McDonald, T. The effect of auditory, supraliminal, and written reinforcement of words presented by i.t.v, on the vocabulary development of seventh and eighth grade pupils. Nineteenth National Reading Conference, 1970, 2, 128-133.

Montague, R. The effect of mediational instructions on associative skills of first grade inner-city children. Paper presented at the annual meeting of the American Educational Research Association, Minneapolis, March 1970.

Oakan, R.; Wiener, M.; and Cromer, W. Identification, organization, and reading comprehension for good and poor readers. Journal of Educational Psychology, 1971, 62, 71-78.

Onaver, A. A comparison study of semantic and syntactic cueing by low reading performance college freshmen. National Reading Conference, Inc., Marquette University, 1971, 1-15.

Paivio, A. Imagery and language. Research Bulletin No. 167, University of Western Ontario, London, 1970.

Paivio, A. Imagery and Verbal Processes. New York: Holt, Rinehart, and Winston, 1971.

Paivio, A. Mental imagery in associative learning and memory. Psychological Review, 1969, 76, 241-263.

Pettit, N. and Cockriel, I. A factor study of the Literal Reading Comprehension Test and the Inferential Reading Comprehension Test. Journal of Reading Behavior, 1974, 63-75.

Proger, B.; Taylor, R.; Mann, L.; Coulson, J.; and Bayuk, R. Conceptual pre-structuring for detailed verbal passages. The Journal of Educational Research, 1970, 64, 28-34.

Raygor, A. Behavior analysis, the new look in reading research. Fourteenth National Reading Conference, 1965, 224-236.

Raygor, A.; Wark, D.; and Warren, A. Operant conditioning of reading rate: The effects of a secondary reinforcer. Journal of Reading, 1966, 9, 76-79.

Richards, I. A. Practical Criticism. New York: Harcourt Brace, 1929.

Robinson, H. Visual and auditory modalities related to two methods for beginning reading. Reading Research Quarterly, 1972 (Fall), 7-39.

Rohwer, W. D. Images and pictures in children's learning: Research results and instructional implications. Psychological Bulletin, 1970, 73, 393-403.

Rothkopf, E. Z. Structural text features and the control of processes in learning from written materials. In R. O. Freedle and J. B. Carroll (Eds.), Language Comprehension and the Acquisition of Knowledge. Washington: V. H. Winston and Sons, 1972, 315-335.

Rothkopf, E. Z. The concept of mathemagenic activities. Review of Educational Research, 1970, 40, 325-336.

Rothkopf, E. Z. and Bisbicos, E. E. Selective facilitative effects of interspersed questions on learning from written materials. Journal of Educational Psychology, 1967, 58, 56-61.

Rystrom, R. Toward defining comprehension: A first report. Journal of Reading Behavior, 1970, 2, 56-74.

Samuels, J. Effects and pictures on learning to read, comprehension, and attitudes. Review of Educational Research, 1970, 40, 397-407.

Schaeffer, L. and Schaffer, J. A secondary remedial reading program based on principles of reinforcement theory. Washington, D.C.: Office of Education, 1969, 24 pages.

Schaeffer, L. and Schaffer, J. Conditioning verbal behavior in a controlled learning environment. Journal of Reading, 1969, 541-606.

Schnell, L. Promising possibilities for improving comprehension. Journal of Reading, 1972, 415-424.

Schnell, T. The effect of "organizers" on reading comprehension of community college freshmen. Journal of Reading Behavior, 1973, 5, 169-176.

Schneyer, W. Instruction in listening. Reading Teacher, 1971, 24, 369-374.

Simon, H. D. Reading comprehension: The need for a new perspective. Reading Research Quarterly, 1971, 7, 338-364.

Singer, H. Substrata-factor theory of reading, research, and evaluation of critiques. Proceedings of the International Reading Association, 1965, 10, 325-331.

Skinner, B. A case history in scientific method. Cumulative Record. New York: Appleton-Century-Crofts, 1959.

Skinner, B. F. Verbal Behavior. New York: Appleton-Century-Crofts, 1957.

Staats, A. A case in and a strategy for the extension of learning principles to problems of human behavior. In L. Krasner and L. P. Ullmann (Eds.), Research in Behavior Modification. New York: Holt, Rinehart and Winston, 1965, 27-55.

Staats, A.; Minke, K.; Finley, J.; Wolf, M.; and Brooks, L. A reinforcer system and experimental procedure for the laboratory study of reading acquisition. Child Development, 1964, 35, 209-231.

Sticht, T. G. Learning by listening. In R. O. Freedle and J. B. Carroll (Eds.), Language Comprehension and the Acquisition of Knowledge. Washington: V. H. Winston and Sons, 1972, 315-335.

Sticht, T. G. Learning by listening in relation to aptitude, reading, and rate controlled speech. (Technical Report 69-23). Human Resources Research Organization, Alexandria, Va., 1969.

Sticht, T. G. Learning by listening in relation to aptitude, reading, and rate controlled speech: additional studies. (Technical Report 71-5) Human Resources Research Organization, Alexandria, Va., 1971.

Swenson, I. and Kulhavy, R. Adjunct questions and the comprehension of prose by children. Journal of Educational Psychology, 1974, 66, 212-215.

Thorndike, E. L. Reading as reasoning: A study of mistakes in paragraph reading. Journal of Educational Psychology, 1917, 8, 323-332.

Thorndike, E. L. The psychology of thinking in the case of reading. Psychological Review, 1917, 24, 220-234.

Tolman, E. C. Purposive Behavior in Animals and Men. New York: Appleton-Century-Crofts, 1932.

Tuinman, J. and Blanton, B. Rystrom's model for the last time. Journal of Reading Behavior, 1971, 3, 47-51.

Wark, D. Application of operant conditioning in a college reading center. Sixteenth National Reading Conference, 1967, 27-37.

Wark, D. Case studies behavior modification. Eighteenth National Reading Conference, 1969, 217-228.

Wark, D.; Kolb, M.; and Tonn, J. Operant conditioning techniques with disadvantaged students. College and Adult Reading Yearbook (5), NCRA, 1968.

Waugh, R. Relationship between modality preference and performance. Exceptional Children, 1973, 465-469.

Weinstein, R. and Rabinovitch, M. Sentence structure and retention in good and poor readers. Journal of Educational Psychology, 1971, 62, 25-30.

Wiener, M. and Cromer, W. Reading and reading difficulty: A conceptual analysis. Harvard Educational Review, 1967, 37, 620-643.

Wilder, L. Spoken rehearsal and verbal discrimination learning. Speech Monographs, 1971, 38, 113-120.

Wolff, P. and Levin, J.R. The role of overt activity in children's imagery production. Child Development, 1972, 43, 537-547.

Yuille, J. and Paivio, A. Abstractness and recall of connected discourse. Journal of Experimental Psychology, 1969, 82, 467-471.

APPENDICES

APPENDIX A

TABLE 8

EXPERIMENTAL DESIGN

(Two Reader Types x Three Treatments x Two Modalities)

Classification	Treatment	Modality: Reading	Modality: Listening
Deficit	Control		
	Imagery		
	Incentive		
Average	Control		
	Imagery		
	Incentive		

NOTE: The design is one of repeated measures (within treatment groups) such that subjects assigned to a particular treatment group remained in that group under both modalities, e.g., deficit readers assigned under control remain in that condition across reading and listening modalities.

APPENDIX B

INSTRUCTIONS FOR READING, LISTENING, IMAGERY, AND INCENTIVE

Introduction

You have been selected to participate in a survey in reading comprehension. Do you have any idea what the survey is like? (If subject responds "yes" E will probe further to determine if S anticipates an incentive condition or knows anything about the stories, questions, or answers.) (If S responds "no")--Well, each person in this survey including yourself, will be asked to read and/or listen to two stories and answer questions about them. For participation in this study I am going to give all subjects ten cents at the start. Here is your ten cents. All subjects will be paid just for helping us out. Please do not tell any of your friends about this because I want it to be a surprise for them.

Instructions for Treatment

Reading

I am going to give you some sentences to read. Take as much time as you need to read each sentence because all of the sentences together tell a story. I will place a booklet of cards in front of you with one sentence on each card. Once you have read the sentence carefully, flip it over and go on to the next one. After you have read all the sentences I will ask you some questions about the story.

Do you have any questions? OK, now I am going to let you see (listen to) the sentences and try to remember the story they tell. (After S is finished): Now I am going to ask you a few questions.

Listening

I am going to let you listen to some sentences which have been tape recorded. Listen to each sentence carefully because all of them together tell a story. I will put the tape player in front of you and turn it on when I say "ready." Once I have turned the tape player on please do not ask questions or interrupt the recording. I will only play the sentences through once, so listen carefully. After you have listened to all the sentences, I will then ask you some questions about the story.

Imagery (Add)

We have discovered a little trick that will help you remember what the story is about. While you are reading (listening), try to get a picture in your mind of what the words are saying. Imagine what the people in the story are doing and picture what each sentence is saying. Later on, when I ask you the questions, think back to the pictures that you had, and that will help you remember the story.

Let's try an example. Suppose one of the (sentences) you heard (read) was this one: "The spider climbs the shirt." Can you think of a picture in your mind of a spider

crawling up someone's shirt? What kind of shirt is it? How big is the spider? Well, your picture might have looked like this one--or maybe you pictured a smaller spider and a different kind of shirt. But the picture you make up will help you remember the story.

Later if I asked you: "What was the spider doing, what would be your answer?" ("Think back to your picture.")

Incentive (Add)

You can earn additional money depending on the number of questions you can correctly answer. For each correct answer I will give you one penny (p shows penny). In addition to the 10 cents I just gave you, it is possible for you to earn more than 25 cents. I will tell you how much additional money you have earned only when the questions are all answered, i.e., at the end of the questions for both stories.

Example (Add for Each Condition)

Let's try an example. Suppose one of the sentences you read (heard) was this one: "The spider climbs the shirt." Later if I asked you what was the spider doing, what would be your answer?

Story 1

This story describes the start of a race between two automobiles. Vehicle number one is a maroon station wagon. It is tall and rectangular in shape like an oversized box. The driver occupying this car is wearing a protective helmet. Vehicle number two is a foreign sports car called a "Jaguar." It is long and low in shape like an African "jaguar" cat. Protective goggles are strapped on this driver's head.

Both cars are competing for a silver plaque. The entire race is eight laps around an oval track. The drivers are nervous as they await the start. The huge crowd gathered is extremely noisy. The start is signalled by the firing of a pistol. The race has begun but both cars remain motionless. Neither driver could hear the starting signal.

Questions - Story 1

1. What is the story about?
   race; _____
2. What color is vehicle number one?
   maroon; red; _____
3. What shape is vehicle number one?
   tall and rectangular; _____
4. What is the driver of vehicle number one wearing?
   protective helmet; _____
5. What kind of car is vehicle number two?
   Jaguar; foreign sports car; _____
6. What shape is vehicle number two?
   long and low; _____
7. What is the driver of vehicle number two wearing?
   protective goggles; _____
8. What prize are the cars competing for?
   silver plaque; _____
9. How many laps is the race?
   eight; _____
10. How do the drivers feel while they are waiting for the start?
    nervous; _____
11. What is noisy at the start?
    the huge crowd; _____
12. How is the race started?
    by firing a pistol; _____
13. What did the cars do when the race started?
    cars didn't move; _____
14. Why didn't the cars start moving?
    the drivers didn't hear the signal; _____

Story 2

This story describes two species of monkeys. One kind has a light slender body and long limbs like a spider. This monkey dwells primarily in forests. It is famous for its unusually long tail. Older monkeys use their tails to perform acrobatics in the trees. When traveling the infants curl their tails around their mother's waists. At night these monkeys sleep crouched on a tree branch.

Another kind of monkey lives primarily in the mountains. It is famous for its long muzzle and "dog-like" face. It has a heavy muscular body. These monkeys travel on all fours with their tails arched upwards. When traveling the infants sit upright on their mothers' backs. These monkeys usually sleep in caves at night. Both species of monkeys grasp objects in their hands like humans.

Questions - Story 2

1. What is the story about?
   two types of monkeys; _____
2. What does the slender monkey look like?
   a spider; _____
3. Where does the slender monkey live?
   forests; _____
4. What is the slender monkey famous for?
   long tail; _____
5. What do the older monkeys use their tails for?
   to perform acrobatics? _____
6. What do the infants of the slender monkeys do when traveling?
   curl tails around mother's waist; _____
7. Where do the slender monkeys sleep at night?
   on a tree branch; _____
8. Where does the other type of monkey live?
   mountains; _____
9. What is it famous for?
   "dog like" face; _____
10. What is its body like?
    heavy and muscular; _____
11. How do they carry their tails?
    arched upwards; _____
12. How do the infants travel?
    upright on their mother's back; _____
13. Where do they sleep at night?
    in caves; _____
14. How do both species of monkeys grasp objects?
    with hands; _____

APPENDIX C

TABLE 9

READING AND LISTENING DATA: ANALYSIS OF COVARIANCE FOR DEFICIT READERS

		Reading		Listening	
Source	df	MS	F	MS	F
Conditions	2	3.77	<1	2.04	<1
Error	35	6.55		7.57	

TABLE 10

READING AND LISTENING DATA: ANALYSIS OF VARIANCE FOR AVERAGE READERS

		Reading		Listening	
Source	df	MS	F	MS	F
Conditions	2	6.77	<1	3.06	<1
Error	36	7.93		4.94	

TABLE 11

ANALYSIS OF COVARIANCE OF "LIKE" AND "IMAGERY" RATING DATA FOR THE DEFICIT READERS

		Reading-Like		Listening-Like		Reading-Imagery		Listening-Imagery	
Source	df	MS	F	MS	F	MS	F	MS	F
Condition	2	.57	1.01	.17	<1	.47	<1	.66	1.31
Error	35	.56		.47		.52		.50	

TABLE 12

ANALYSIS OF VARIANCE OF "LIKE" AND "IMAGERY" RATING DATA FOR THE AVERAGE READERS

		Reading-Like		Listening-Like		Reading-Imagery		Listening-Imagery	
Source	df	MS	F	MS	F	MS	F	MS	F
Condition	2	.39	<1	.14	<1	.52	1.74	.08	.<1
Error	36	.46		.34		.29		.39	